To inspire ambition, to stimulate the imagination, to provide the inquiring mind with accurate information told in an interesting style, and thus lead into broader fields of knowledge—such is the purpose of this work

The New PICTURED ENCYCLOPEDIA

Volume Six

Made and Printed in Great Britain by The Amalgamated Press Ltd

COLOUR & BEAUTY AMONG THE BUTTERFLIES

Lo the bright train their radiant wings unfold!
With silver fringed and freckled o er with gold
On the gay bosom of some fragrant flower
They idly fluttering live their little hour,
Their life all pleasure and their task all play,
All spring their age, and sunshine all their day

—MRS BARBAULD

Painting by MILO WINTER *See text overleaf*

The favourites of children among the tribes of insects are the butterflies, whose gay, happy colours dancing in the sunshine seem to reflect the spirit of carefree youth Identifying them with the key on the back of this page will be fun

COLOUR AND BEAUTY AMONG THE BUTTERFLIES

WHAT a joy to be a boy or a girl or a butterfly on a happy day of sunshine and merry winds! While a bee is all business because there is so much to do putting away honey for the winter, the butterflies haven't a care in the world. Nobody to look after but themselves, living on an occasional sip of nectar, they spend the livelong day flitting and drifting about in the golden air.

It is the "wondrous sculptured dust," the scales on their wings, that breaks up the rays of sunlight falling upon them and produces all the beautiful colours and shadings of butterflies and moths. But how a gaudy butterfly, like the Kallima of India, ever got put together so that the moment he settles on a twig and folds his gay wings he looks like an old and withered leaf—that nobody knows. Possibly you may be the very boy or girl to find out some day. Many Nature secrets quite as mysterious have been solved by men of science who began amusing themselves with Nature's puzzle pages just as you are doing this very minute.

From the top to the bottom of the gay curving line of butterflies shown overleaf, we see in succession an American Swallowtail, a Camberwell Beauty, a Clouded Yellow female, a Buckeye butterfly, a Small Sulphur, a Clouded Yellow male and a Monarch or Milkweed.

THE NEW PICTURED ENCYCLOPEDIA

A Pictorial Treasury of Reading
& Reference for Young and Old

Edited by
SIR JOHN HAMMERTON

Editor, Universal Encyclopedia, Universal History of the World, Peoples of All Nations
Countries of the World Encyclopedia of Modern Knowledge New Popular Educator

With Eight Thousand Illustrations including
nearly Eight Hundred in Colour & Photogravure

*Complete in Ten Volumes including Easy Reference Fact-Index
Study Outlines and Topics Guide to Every Day of the Year*

VOLUME SIX LAB—NAV

THE STANDARD LITERATURE COMPANY LTD
Calcutta - - - Rangoon - - - Colombo - - - London

HERE AND THERE IN THIS VOLUME

At odd times when you are just looking for "something interesting to read," without any special plan in mind, this list will help you With this as a guide, you may wander through storyland, visit far-away countries, meet famous people of ancient and modern times, review history's most memorable incidents, explore the marvels of Nature and science, play games—in short, find whatever suits your fancy at the moment This list is not intended to serve as a table of contents, an index, or a study-guide For these turn to the Fact-Index and Study Outlines in Volume Ten

TALES FOR THE STORY HOUR

HIGH-LIGHTS IN HISTORY'S PAGEANT

SOME FAMOUS MEN AND WOMEN

GLIMPSES OF LANDS ACROSS THE SEAS

HELPS TO HOME-WORK

STRANGE WAYS AND THINGS

SIGN-POSTS TO LITERATURE AND ARTS

THE WONDER WE CALL 'LIFE'

THE WORLD AT WORK

IN THE PLANT AND ANIMAL WORLD

MARVELS OF SCIENCE AND INVENTION

RAMBLES THROUGH FACT-LAND

CAN YOU ANSWER THESE QUESTIONS?

Since unnumbered thousands of questions are answered in each one of our ten volumes, this page is intended merely as a sample of the pleasure and instruction that may be obtained by discovering interesting facts in this volume and passing them on to others in question form There are many thousands more for you to draw upon as tests in General Knowledge

	PAGE
What and where is the Lutine Bell ?	2535
Why do some plants " go into partnership " ?	2485
Who was Britain's first Labour Premier ?	2418
Have all lizards got legs ?	2530
How can you see the invisible ?	2728
Who were the Nine Muses ?	2847
What is the origin of the term " knot " for speed at sea ?	2553
What missionary was mauled by a lion ?	2526
What insects give us shellac ?	2424
What were the first loganberry's parents ?	2554
When does the cuckoo arrive in England ?	2734
What mushrooms must you *never* eat ?	2850
Who was the " Citizen King " ?	2576
What animal can grow a new tail ?	2529
What Red Indian game is played in girls' schools ?	2425
Who invented " logs " ?	2555
Why are we told to " drink more milk " ?	2740
What are the movements in a sonata ?	2855
Why is lisle thread so called ?	2497
What colour is a live lobster ?	2535
How do bees find the nectar in " Lady's Slippers " ?	2428
How was Elsa's curiosity punished ?	2556
What great poet went blind ?	2743
What dictator is a blacksmith's son ?	2861
Who wrote a dissertation on roast pig ?	2432
What fish can live long out of water ?	2587
How are mineral waters made ?	2747
What love-lorn youth gave his name to a flower ?	2873
What creature chews with its claws ?	2536
Who designed the Cenotaph in London ?	2590
What is a mirage ?	2757
Can you recognize the National Mark ?	2875
Where is the Lansbury Lido ?	2437
Why are some people called " lynx-eyed " ?	2592
Why do we hang up mistletoe at Christmas ?	2762
How can you go hunting with a camera ?	2886
What musician began to compose at the age of five ?	2836
Where is the " zero hour " of longitude ?	2445
What Shakespeare character lived in our Queen's ancestral castle ?	2598
When did motor-cars have a man walking in front carrying a red flag ?	2817
How do you find the area of a circle ?	2703
When were matches first sold ?	2677
How do you know whether it is a gnat or a mosquito that has bitten you ?	2814
How does an escalator work ?	2489

	PAGE
Which British coin bears the picture of a wren ?	2771
Where and what is the " Brown House " ?	2843
What animal has been known to tunnel nearly 100 yds in one night ?	2765
What poison is used for flavouring icing ?	2448
How did Machiavelli get such a nasty reputation ?	2600
What bird travels almost from one end of the earth to the other twice a year ?	2733
How do you score in lawn tennis ?	2454
Why do cart horses wear brass ornaments ?	2617
Is he the world's ugliest animal ?	2780
How can you distinguish a gunner's mate from a leading stoker ?	2899
How can you enter the Royal Navy ?	2904
What meat is forbidden to Moslems ?	2622
Why do so many people have the name " Smith " ?	2866
Where are a leaf's mouths ?	2464
How many toes has a pig on each foot ?	2632
In what country is Monte Carlo ?	2791
Which leader of the French Revolution was killed in his bath ?	2652
What do the Germans call " Shockheaded Peter " ?	2520
Why do we say people of wealth have the Midas touch ?	2728
When was the first wireless message sent from England to America ?	2654
Fill in the blanks in *a pride of* , *a gaggle of* , and *a watch of*	2841
Why do leaves fall in the autumn ?	2466
What is the difference between butter and margarine ?	2656
Which of our months are named after Roman emperors ?	2794
What nationality was Napoleon ?	2869
What is the difference between " legend " and " myth " ?	2468
How do the Mexicans collect pulque ?	2721
Whose was the first house lit by gas ?	2843
Why didn't the lion kill Androcles ?	2515
How many kilometres are there in five miles ?	2716
What pirate became governor of a colony ?	2804
Who painted " Mona Lisa " ?	2477
How many families has Mother Mouse a year ?	2833
Why couldn't you make a noise on the moon ?	2798
Who founded " Scientific Socialism " ?	2670
What is the " synchro-mesh gear-box " ?	2827

COLOUR and GRAVURE PLATES and PAGES

IN THIS VOLUME

WHEN YOU ARE IN NEED OF READY REFERENCE

In using THE NEW PICTURED ENCYCLOPEDIA as a work of reference, Volume Ten is indispensable As regards its contents that particular volume is unique, for it is at once a complete Index to the preceding Nine Volumes, and an Encyclopedia in itself Its purpose is fourfold, as indicated below

(1) Through the Year with the N P E Its opening section takes the form of a Calendar of the Year, giving for each day all the chief events and matters of interest, with references to the pages of THE NEW PICTURED ENCYCLOPEDIA in which full particulars concerning the event, personality, or other interest of the day may be found By the intelligent use of this section (a) the young reader can have the daily delight of reading about topics that have special association with the particular day of the year on which he may be making his reference, (b) father or mother can suggest what would be the most appropriate reading for the day and (c) the school teacher can set the lessons for the day with a genuine topical appeal

(2) Study Outlines This large and important section of the volume provides a simple method of study which should enable any of our young readers to become expert in using THE NEW PICTURED ENCYCLOPEDIA as an auxiliary manual of home study and thus what is learnt in school may be amplified and more securely fixed in the memory

(3) The Fact Index Actually this is in itself a complete Encyclopedia In addition to providing many thousands of references to contents of Volumes One to Nine, it records many more thousands of facts in biography, geography, history science, the arts, etc that are not mentioned in its nine predecessors Therefore if you look in vain for any subject in the alphabetical order of Volumes One to Nine, turn to Volume Ten and you will almost certainly find it there

It is a good plan when using THE NEW PICTURED ENCYCLOPEDIA as a work of reference always first to look up any subject in the Fact-Index of Volume Ten

(4) Thousands of Additional Entries Not only are all the many thousands of statements of fact that appear in the main body of the work carefully recorded in the Fact-Index for your immediate reference but many thousands of additional entries are given in this exceedingly useful section of our work By this method the reading pages of the work are saved from the burden of thousands of brief cross references which the ordinary encyclopedic method would involve These new entries in the Fact-Index together with the treasury of reading embodied in Volumes One to Nine make THE NEW PICTURED ENCYCLOPEDIA the most comprehensive encyclopedic work produced in the present generation and assuredly the most readable encyclopedia of its kind

KEY TO PRONUNCIATION

Most of the subject-headings in THE NEW PICTURED ENCYCLOPEDIA require no special indication of the way in which they should be pronounced. There are also many for whose proper pronunciation it is only necessary to know which syllable is stressed; in these cases the stress is shown *after* the syllable, thus A'jax. Where further guidance is necessary, the following signs are employed:

ah = a as in father
aw = a as in ball
ê = vowel sound in fern, word, girl, curl
ow = vowel sound in now, bout
oi = vowel sound in noise, boy
Unmarked vowels have their **short sound**, as a in hat, e in bet, i in bit, o in not, u in but, oo in book.
Marked vowels have their **long sound**, as in hāte, bē, bīte, nōte, tūne, bo͞on.

Vowels in italics have a slurred or obscure sound as in abet (*a*-bet'), recent (rē-sent), conform (k*o*n-form'), nation (nā'sh*u*n), tailor (tā'-lor).
th = first sound in thing, thank
th = first sound in the, that
zh = s in measure, leisure
g = hard g, as in good, girl
j = soft g, as in gem, ginger
kh = guttural in loch

LIST OF ABBREVIATIONS

The abbreviations most commonly used in this work are noted below: a much longer list of abbreviations often met with in reading or conversation is given in the Fact-Index that is contained in Volume Ten.

A.D., *Anno Domini* (in the year of our Lord, of the Christian era)
a.m., *ante meridiem* (before noon)
b., born
B.C., before Christ
C., Centigrade
c., *circa* (about)
Co., county, company
d., died
e.g., *exempli gratia* (for example)
etc., *et cetera* (and so forth)
et seq., *et sequens* (and following)
F., Fahrenheit
h.p., horse-power
i.e., *id est* (that is)
lb., pound, pounds (weight)
m., miles
MS., MSS., manuscript, manuscripts
oz., ounce, ounces
p.m., *post meridiem* (after noon)
Pop., population
Pron., pronunciation
q.v., *quod vide* (which see)
sq. m., square miles
St., Saint
U.S.A., United States of America
viz., *videlicet* (namely)
yd., yard

THE letter L is thought to be descended from the ancient Egyptian hieroglyph representing a lioness which became the symbol , or when written in a running hand Here we can already see some resemblance to our letter The Phoenicians wrote it like this and called it *Lamed*, "ox goad," from its resemblance to that object The Greeks called it *Lambda* and turned it about so that it looked like our V upside-down, Λ The Romans straightened it out to the form we have today The sounds *l* and *r*, known as the liquids are very closely related In fact, scholars tell us that in Egyptian, as in some other languages no clear distinction was made between them the signs for these sounds being used interchangeably There are peoples, the Chinese for example, who cannot sound the *r*, and these substitute *l* for *r*, as when they say *velly* for *very* This use of *l* for *r* is known as "lambdacism" The Japanese, on the other hand, substitute *r* for *l*

Labour, Ministry of This Government department was established in 1916 to take over all the affairs previously under the Labour Department of the Board of Trade Its activities include unemployment and insurance, administered through labour exchanges, friendly societies, and trade unions, the Industrial Court, to deal with claims, and employment and training of juvenile workers There are also special branches for industrial relations, statistics, and the International Labour Office attached to the League of Nations The headquarters of the Ministry are at Montagu House, Whitehall, London

Labour Movement. After the introduction of the factory system as a result of the Industrial Revolution in the 18th and 19th centuries, independent handworkers became merely wage-earners, completely dependent on their employers Competition forced them to accept low wages, and it also in many instances made them endure a working day of 12 to 14 hours, with unhealthy working conditions

When working men protested separately against these conditions, they seldom gained their demands and, indeed, often lost their positions Accordingly, workers in industrial countries began to unite for self-protection in trade unions and other labour organizations now about 3,820,000 workers belong to registered labour unions in Great Britain

The first trade unions were formed in England by the tailors and wool-workers, who found that they could improve labour standards only by collective bargaining with their employers Previous efforts of labour to organize had been discouraged, from as early as the 14th century by scores of court decisions, and labour unions did not receive full legal recognition until the Trade Union Acts of 1871 and 1876

As labour gained power through organization, political parties arose in most of the industrial nations to represent the workers in government In England two significant movements were forerunners of later political organization of workers The Owenites, followers of Robert Owen (1771-1858), Socialist and reformer, sought, among other aims the betterment of working and living conditions for the masses, and the Chartist Movement, started by the London Working Men's Association in 1837, urged political reforms Later, Socialist groups, organized locally, sought to gain a voice in governmental matters Notable among these were the Fabian Society, 1884, noted for the number of "intellectuals" among its members, and the Scottish Labour Party, formed under the leadership of Keir Hardie in 1889

When efforts to elect labour candidates failed, various labour groups united to form the

Photo Burratt

FIRST PARLIAMENTARY LABOUR PARTY

This photograph, taken in February 1906, at the House of Commons, shows the leaders of the first Parliamentary Labour Party They are from left to right Arthur Henderson, G N Barnes, Ramsay MacDonald, Philip Snowden, W Brace, Will Crooks Keir Hardie, J O'Grady, and David Shackleton

Independent Labour Party in 1893 The trade unions and Socialist organizations united in 1900 to form the Labour Representation Committee, which became the Labour Party in 1906 In 1924 a Labour government took office for the first time, with Ramsay MacDonald as Prime Minister A second one held office from 1929 to 1931

Both Australia and New Zealand have had Labour governments In nearly all European countries the Social-Democrats correspond in a general way to the Labour Party in England After the World War the Social-Democrats of Germany formed the new democratic constitution in force from 1919 to 1932 (*See also* Socialism)

Labrador. Patches and columns of many coloured lights dance fantastically in the midnight sky above the ice-bound strip of a rugged coast-line rising out of a shadowy phosphorescent sea "The spirits of the dead are at play," the superstitious Eskimo says, as he looks with awe at the wonderful spectacle of these "northern lights" Presently, when they fade, a fiery dawn breaks forth in splendour, disclosing a wall of giant cliffs washed by the deep blue iceberg-strewn Atlantic—a land where fiords and bays carve their way in and out between titanic lichen-grown rocks, white with gulls and other sea-fowl

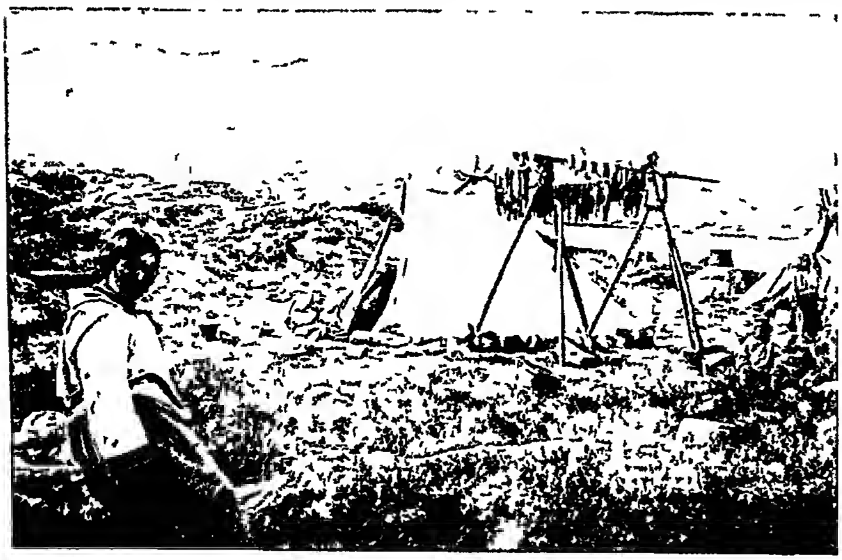
IN HER COAT OF SEALSKIN

This young woman of Labrador wears a sealskin costume as the natural clothing of her country The skin of a Labrador seal, of dappled black and silver, is coarse but handsome

Photo Georg Haeckel

This is Labrador, the most easterly part of the North American continent, an area varying from 10 to 450 miles wide along the mainland of Canada Although on the mainland, Labrador is a dependency of Newfoundland In 1927 the Judicial Committee of the Privy Council fixed the boundaries between Labrador and Quebec, and marked Cape Chidley in the north and Blanc Sablon in the south as its coastal extremes On this basis the estimated area of Labrador is 110,000 square miles The estimated population is under 5,000

Labrador is a lonely land of brief summers and cold stormy winters, perpetually chilled by the icy blasts that sweep across from the Arctic interior, giving it an average temperature far below freezing point, and its ports are ice-blocked until midsummer by the Labrador current flowing down from the Polar regions Labrador is the townless, roadless home of fisherman and trapper, of dog-team and reindeer



SUMMER ON THE COAST OF LABRADOR

For the people of Labrador the months of August and September are the busiest of the year, as it is the cod-fishing season on which they depend for all that money can buy Then, they scatter along the coast, living in tents while they dry, split and salt the fish

Photo Georg Haeckel

The Cree Indian trapper of the south, the squat sturdy Eskimo of the north, and the scattered groups of white settlers are well supplied with firewood, lumber, game, and boots and clothing made of skins Nearly all do their harvesting in the seas Even the trapper, who in winter kills fox, marten, lynx, beaver, otter, mink, and other fur-bearing animals, in summer-time goes fishing for salmon and cod The English medical missionary, Sir Wilfred Grenfell (*q v*), will always be remembered for his work in

relieving the suffering and distress among these hardy fisher-folk.

The interior has fine forests of firs and birches, an enormous quantity of pulp-wood, and abundant iron. It also possesses at Hamilton Inlet, 250 miles from the sea, magnificent water-power. The source of this is the mighty Grand Falls (302 feet high and 200 feet wide), whose roar can be heard 20 miles away. If these falls could be turned to work, it is said they would develop sufficient energy to operate a large proportion of all the factories and railways of Canada.

After John Cabot discovered the coast in 1497, fishermen from England, France, Spain, and Portugal flocked to it, attracted perhaps by Sebastian Cabot's assertion that cod-fish were so numerous that "they sumtymes stayed his shippes." The interior was little known until 1840. An offer by Newfoundland to sell Labrador to Canada was rejected in 1932.

DAINTY LACE *and* HOW *it is* MADE

One of the most beautiful handicraft products, lace has been to most a joy to see and to many a pleasure to make for hundreds of years. The main kinds and their characteristics are described here.

Lace. Formerly the production of lace fabrics was a slow process, demanding great skill and infinite care. Also it was an expensive handicraft to patronize. At the Paris Exhibition in 1867, for example, there was a dress of filmy lace which was valued at £3,500. To make the cobweb-like fabric of this dress 40 women toiled day after day for seven long years.

Point de gaze lace

This is only one example of the extreme costliness of lace, and the painstaking toil required in its making before the invention of lace-making machines made possible the mass production of cheap lace. Today this industry is of mammoth proportions. On these machines many thousands of yards of lace can be woven in less time than half a hundred workers can make a few inches of hand-made lace of the same pattern. Some of these machine-made laces are so exquisite in beauty of design and perfection of finish that it is difficult for the inexpert to distinguish them from hand-made laces.

The lace-making machine is one of the marvels of the commercial world. Imagine a machine carrying on its reels, which are placed one above the other, fine threads set so close together that a sixpence can only just pass edgeways between them. The power is turned on, and shining little flattened bobbins dance in and out between the close-set threads. Sometimes they dart swiftly over one thread and under the next, sometimes they stop and vibrate rapidly a fraction of a second before they go on.

This vibrating movement twists sometimes the warp threads fastened to the reels and sometimes the bobbin threads, and the patterns are made by these twisted threads. Combs quickly press down through the threads to the completed pattern to make it more compact, and more quickly still are up and out of the way. Sixty pieces of lace are often made at once.

As in the case of so many other labour-saving machines, the development of the lace machine to its present perfection was a slow process. In the year 1764 a stocking weaver of Nottingham, examining the lace on his wife's cap, believed that he could make a similar fabric on his stocking machine, and produced an open-weave fabric, which, however, was a knitted fabric made of one thread passing from one end of the frame to the other, and which unravelled if the thread broke.

This was improved by the invention in 1809 of the bobbin net machine, so called because the threads were wound on bobbins, but it was only when Jacquard invented his device for fancy weaving that flowered nets and laces were produced. (*See* Spinning and Weaving.) Nearly every design and mesh of hand-made lace has been mechanically produced. The machine-lace industry of Europe is carried on in Paris, Lyons, Calais, St. Gall, Nottingham, and Plauen.

Lace Made in the Home

Hand-made laces are still made all over the world, but their production in quantities for commerce is confined to France, Belgium, Spain, Ireland, Italy, and England. Because of the infinite care and pains and the great amount of time that have to be taken in its production, hand-made lace will always remain one of the dearest articles of commerce. Some hand-made laces, it is true, are produced easily and cheaply, but on the most delicate finely wrought designs years of labour may be expended.

Hand-made lace is of two types—needle-point and bobbin or pillow lace. Needle-point is made with a needle and a single thread. The pattern,

drawn on parchment, is stitched to a piece of heavy linen for the purpose of holding it straight Threads, sometimes three or four in number, are laid on the many lines of the pattern and are lightly fastened through to the linen The entire figure is then worked, filling and open work mesh by mesh, and when it is completed the stitches holding it to the linen are cut and the lace comes free

In bobbin lace, the design is drawn off on stiff parchment, which is carefully stretched over a "pillow," a round or oval board stuffed to form a cushion, and placed on the knees of the worker The pattern is picked out along the outline of the drawing, and small pins are stuck at close intervals Around these pins threads wound on bobbins of varying size are twisted and crossed to form the various meshes and openings The pattern, or "gimp," is formed by interweaving a much thicker thread Needle-point lace is the heavier lace, and has the appearance of greater strength, but pillow lace is very supple and is prized for the way it can be draped

It is generally agreed that lace, as we understand it today, was first made when Europe, emerging from the severe and formal Middle Ages, began to bedeck itself in a graceful and beautiful manner, although specimens of woven fabrics of lace-like character have been found in the ancient tombs

During the first two centuries of lace-making, men used more lace on their dress than women

SPECIMENS OF OLD LACE

The upper strip is an old specimen of the style known as "Point de Burano," while the lower is of Brussels point, sometimes called English point

It was used for ruffs, cuffs, collars, scarves, and cravats, while ruffles of lace at the top of heavy boots were not unusual The most famous laces of this early time were those of Venice, Milan, and Genoa Venice was celebrated for her points, and Genoa and Milan produced almost exclusively pillow laces Such lace as was woven in the 16th and 17th centuries cannot be made in a commercial way today The modern hand-made lace is often more artistic in design, but it cannot be compared in fineness of execution and thread with the old pieces preserved in libraries and museums

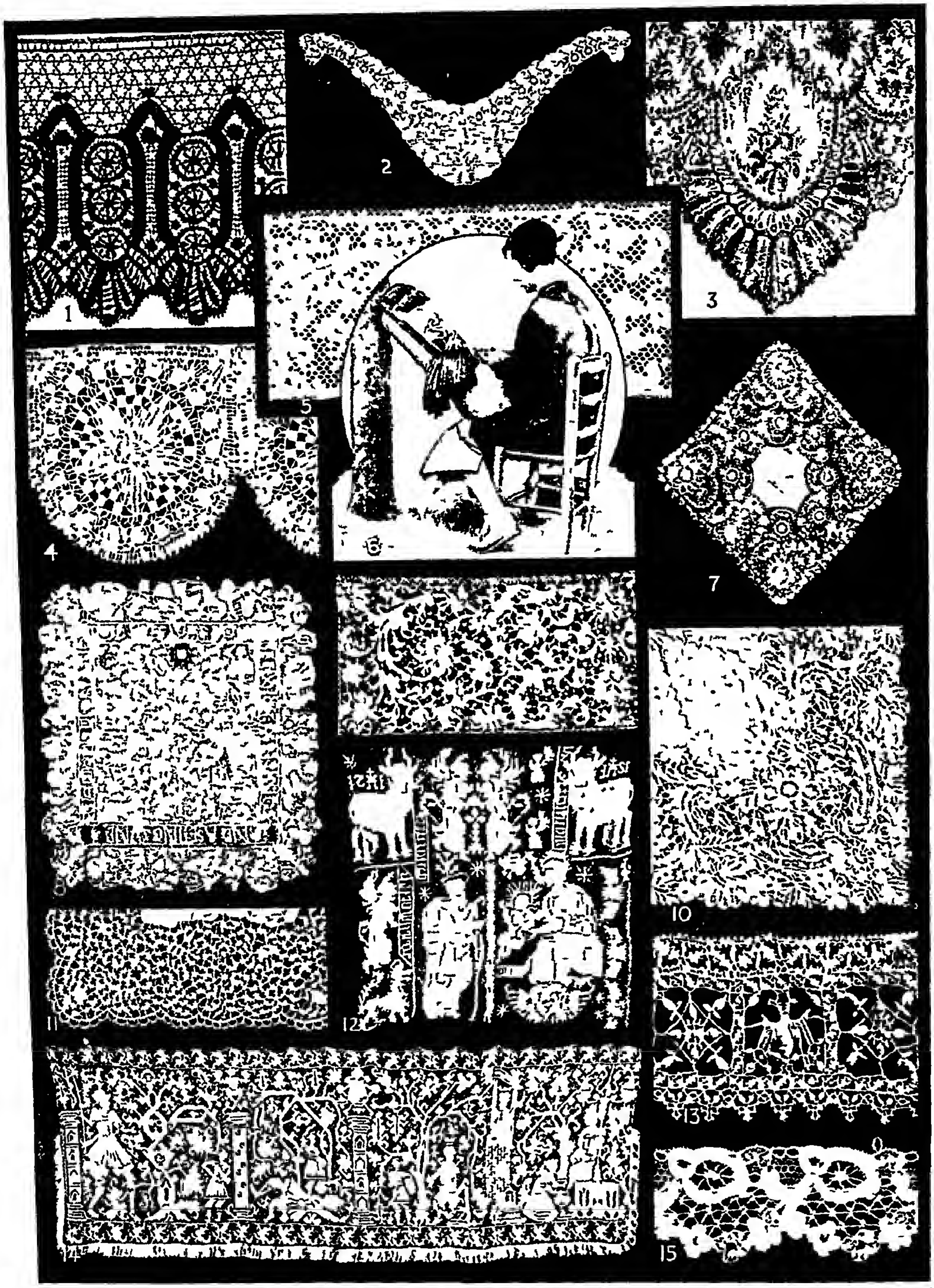
As the industry developed in those early days, the workers broke away from the stiff geometrical designs which mark the early laces The various towns of Italy, France, Belgium, Spain, and elsewhere, sought to make a product of exclusive pattern that would gain them prestige in the few great centres of commerce of that day This explains the various names that were given to types of laces hundreds of years ago, and which still persist Today practically any of the famous patterns can be imitated by machines, and lace curtains are treated with improved dyes produced by the industrial chemist

The better-known hand-made laces are

Alencon A fine needle-point lace named from the town in which it was first made It has a closeness firmness and evenness not found in any other point lace

Brussels Best-known variety is an *appliqué* lace —a lace made by sewing completed patterns on a hand-made or machine-made net

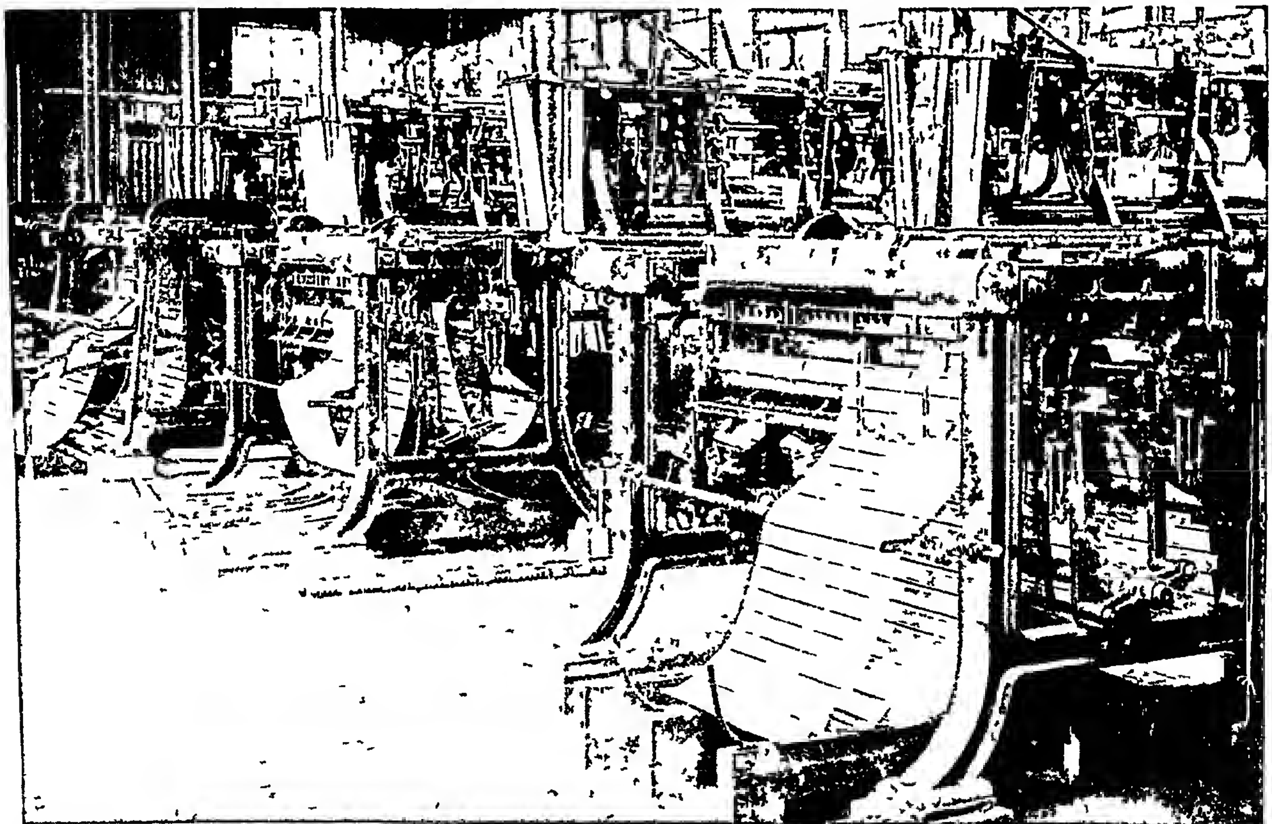
FIFTEEN FAMOUS TYPES OF HAND-MADE LACE



1 This 19th century Saxony guipure in black silk is typical 2 The Maltese cross characteristic of Maltese lace is seen at the edge of this collar of cream silk 3 Most delicate of bobbin lace is Chantilly 4 A drawn-work motif is used in this Mexican lace of alve thread 5 This bobbin lace of Milan is made as seen in picture 6, showing a girl of Valencia Spain at work with bobbins and pillow 7 Netting made with a long steel bobbin adorns this cobwebby handkerchief 8 English needlepoint or point d'Angleterre of the 17th century, forms this bit of church lace showing the temptation of Adam and Eve 9 Venetian point lace, made with a needle is the strongest and most beautifully designed of laces 10 Belgian duchess lace, 19th century, edges this handkerchief 11 A strip of Irish carrickmacross or cutwork lace It is embroidered linen, cut out and joined with lace stitches 12 The nativity is shown in German 16th century filet 13 The double eagle in this 18th century Italian lace is worked with bobbins, the edge is needlepoint 14 A Spanish altar frontal in filet, early 17th century tells the story of David and Goliath in four active scenes, with the killing of the giant plainly visible 15 An interesting design is worked out in German bobbin lace.

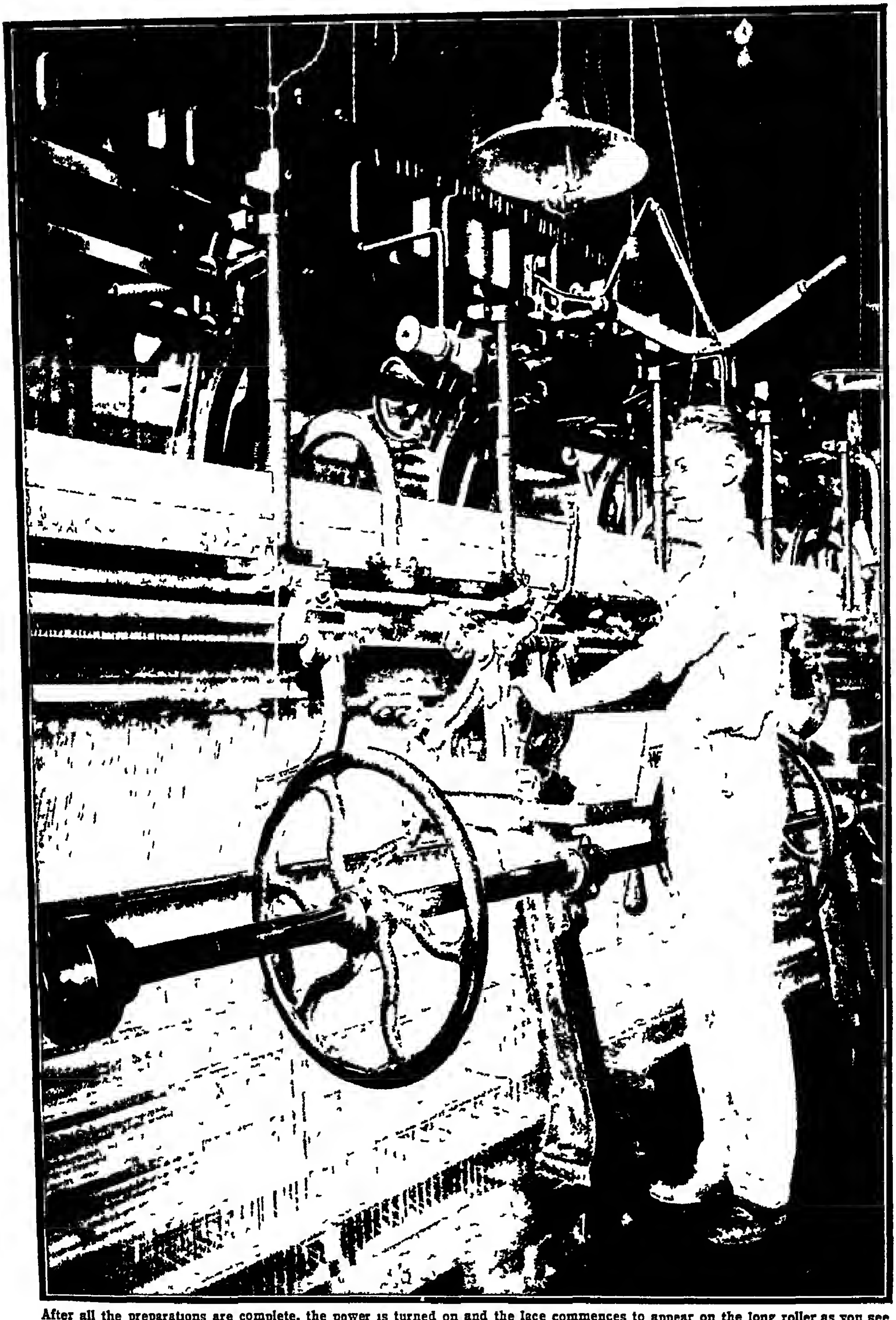
PREPARING A LACE-MAKING MACHINE FOR WORK

Here a skilled operator is fastening together into an endless chain strips of cardboard which he has punched according to the design furnished him by the lace draftsman When ready the chain will be run through the lace machine to control its action Each hole governs a needle in the machine, and the needles, by shifting threads and regulating the tension upon them, produce the pattern

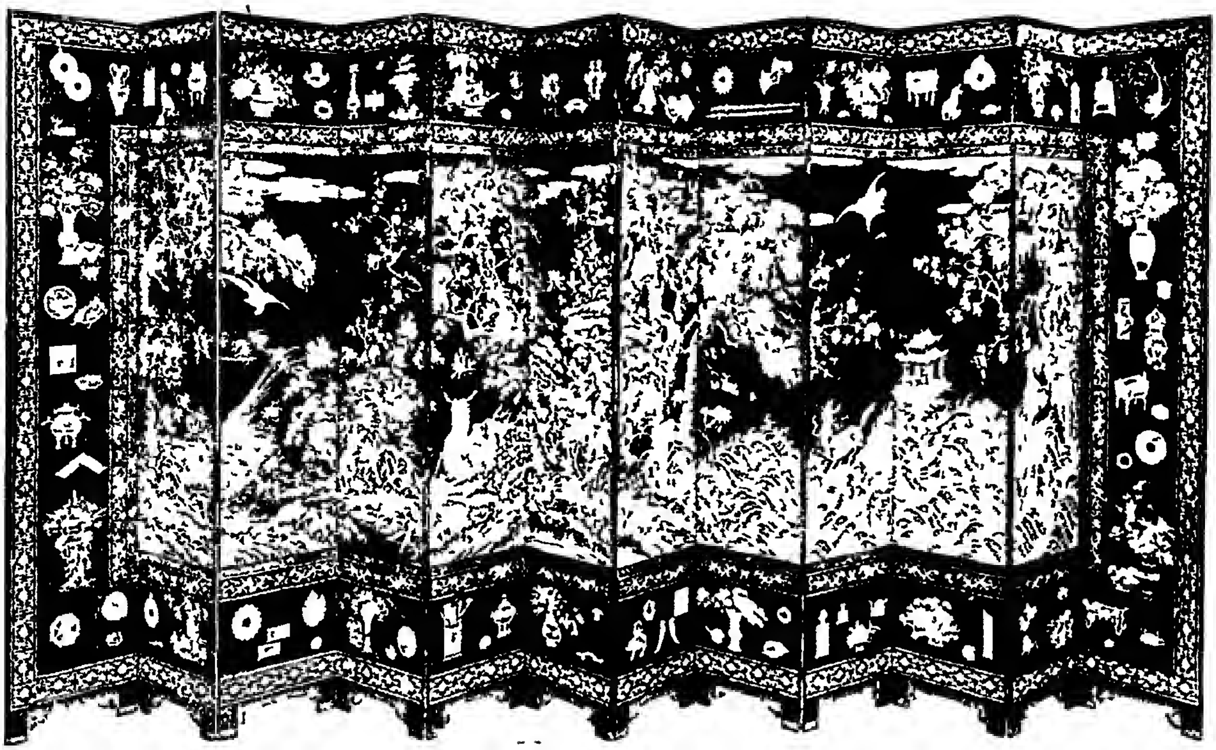


The chains of white strips are the cardboard "controls," punched and in place ready to regulate the play of needles within the machine This control is exercised through steel "droppers" which penetrate the holes as they pass by, and which are connected through a complicated mechanism with the needles You can judge how complex this control is, from the fact that in machines such as these there are 32,000 droppers at work, transferring the "messages" of the cards to the threads

THE MACHINE STARTS—AND OUT COMES THE LACE



After all the preparations are complete, the power is turned on and the lace commences to appear on the long roller as you see here. Tiny needles set like porcupine quills on the roller, catch in the lace and keep it from wrinkling and stretching. Once the machine is going, it will produce sixty yards of lace with a total width of 224 inches, in sixty hours



SUPERB EXAMPLE OF CHINESE LACQUER WORK

In most of the arts requiring great patience and attention to the minutest detail, and in those involving difficult processes that need great care, the Chinese are supreme An example of typical Chinese industry and ingenuity is this magnificent screen of lacquered wood, it is decorated on both sides with incised ornament, painted and gilt on a black ground, and this side shows a mountain scene illustrating some old Chinese legend The height of the screen is 8 ft 10 ins, and its width 21 ft

Victoria & Albert Museum

Cluny A plaited lace made in silk linen, or cotton The patterns are mostly birds, animals, or flowers

Filet Lace A darned net lace

Irish Chiefly a point lace made at Limerick entirely by the needle with very small meshes

Honiton Pillow Made in Honiton, Devonshire, celebrated for the beauty of its figures and sprigs

Valenciennes A solid and durable pillow lace having the same kind of thread throughout for ground and pattern The most beautiful of all French pillow laces

Lacquer AND SHELLAC Nearly everyone has seen those highly polished boxes, trays, cups, and other articles called lacquer-ware The shiny black or red finish was produced by some painstaking Oriental, by one of the longest and most skilful of all artistic processes He covered the wood with cloth or paper, brushed on the lacquer, and, when it was dry, carefully rubbed it down with fine charcoal and water Possibly 18 or 20 preliminary coats of lacquer were applied before the box was ready for decorating with colours or inlaying

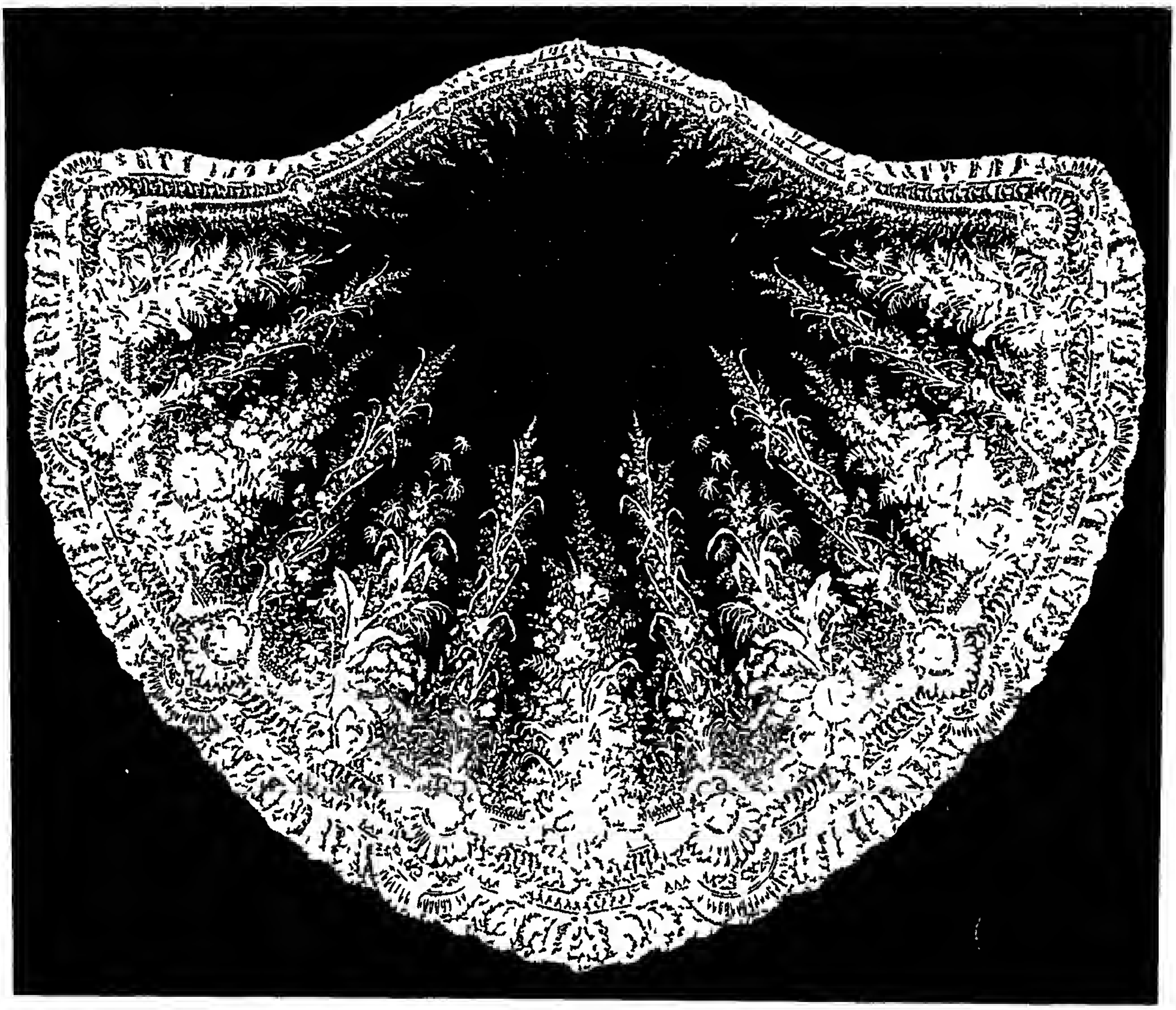
This kind of lacquer, which dries so hard that even hot water will not soften it, is made from the "lac" or sap of the varnish tree (*Rhus vernicifera*) The tree grows abundantly in China, where the art of lacquering was discovered more than 3,000 years ago The Japanese borrowed the art from their neighbours, and imported the varnish tree, which they cultivated in large groves Their artists so surpassed the Chinese that by the 17th century lacquering was known as "japanning" in England English cabinet-makers produced japanned screens and chairs, but these were far inferior to real lacquer-ware

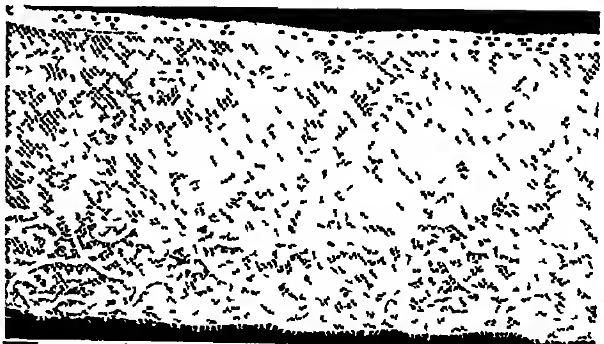
The Japanese, besides lacquering furniture and even their temples, produce some exquisite work on figured vases, gold and silver trays, leather boxes, and other decorative objects The characteristic Japanese lacquer-ware is the gold or silver finish In China, however, carved lacquer has been the object of greater attention, and the Japanese have never really competed in the best of this type of work The Chinese, too, use far more brilliant colours, while they developed the use of iridescent sea-shells also to a greater extent than the Japanese In both China and Japan lacquering is now declining

The lac from which shellac is made is totally different from the lac used in making lacquer-ware It is a secretion from the bodies of tiny reddish scale insects, each individual being smaller than a pin-head The insects are called lacs (*Coccus lacca*) from Hindustani "*lakh*," a hundred thousand, perhaps because it requires thousands of them to produce even a small quantity of shellac, perhaps because the insects are themselves so very numerous

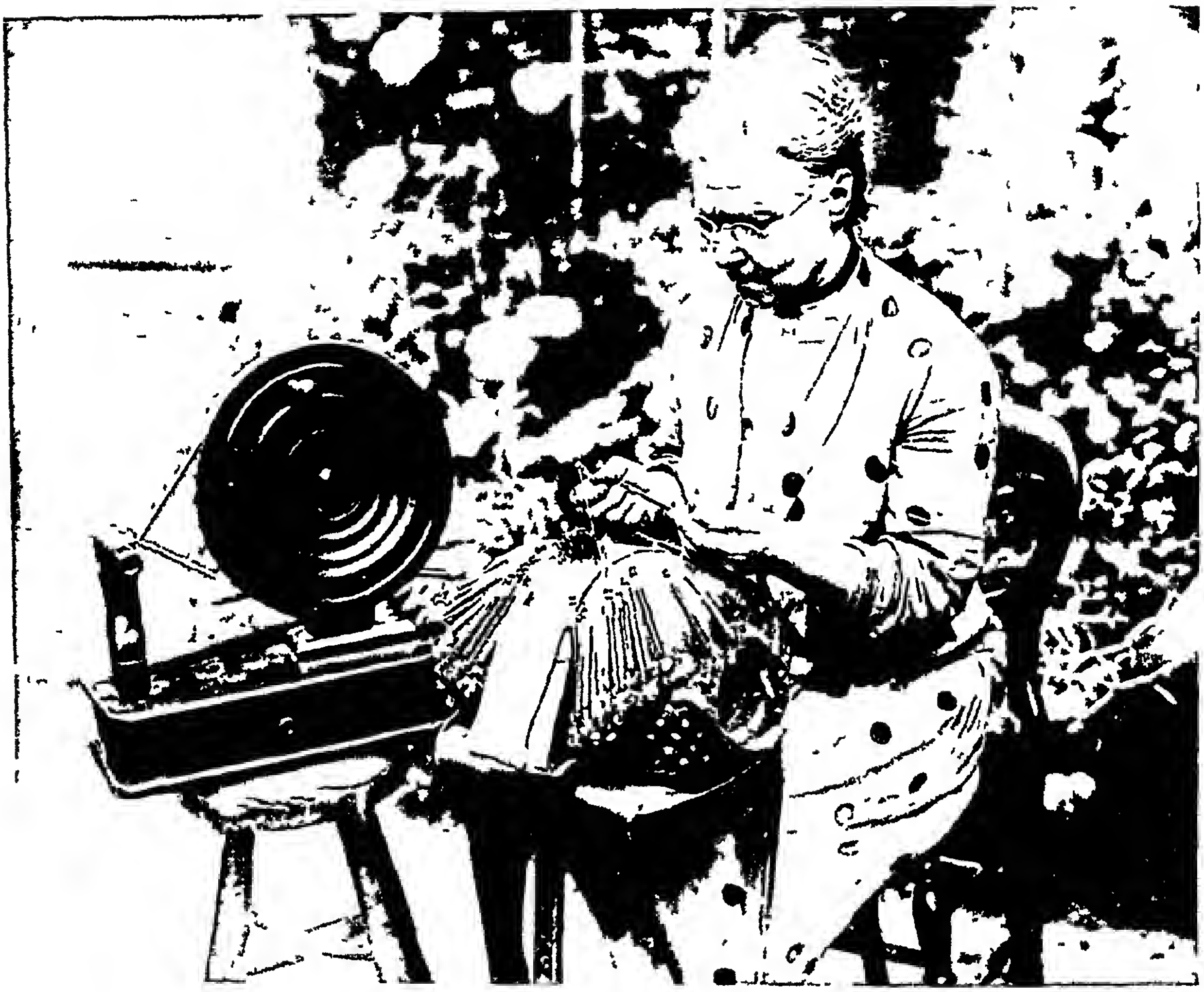
Shellac is used in making gramophone records, and as size or stiffening in felt hats, it holds the bristles in your hairbrush and the glass electric light bulb in its brass base, it is widely used in sealing-wax Toothbrush handles, imitation ivory toilet articles, billiard balls, and

LACE OF FINEST THREAD AND EXQUISITE DESIGN





The four specimens of lace shown in this page represent perfect examples of the old handicraft of lace-making. The top photograph shows the wedding veil worn by the bride of King Farouk of Egypt at her wedding in January, 1938. Made in Brussels some seventy years before, it is a perfect example of needlepoint. Below (left) is a characteristic piece of Honiton lace produced in Devonshire. To the right are (upper) a specimen of Valenciennes lace and (lower) a piece of Italian filet lace of the 18th century.



LACE-MAKING IN AN ENGLISH VILLAGE

LACE MAKING is one of the oldest of village industries, and the pillow lace made in the cottages of Buckinghamshire and Bedfordshire is world-famous This photograph shows a piece of Buckinghamshire lace being made by an expert worker Across the pillow a perforated parchment pattern is stretched In the perforations pins are placed, and the threads, wound on bobbins seen hanging down on the side of the pillow, are worked round the pins to reproduce the pattern Beside the lace-maker is the machine used for winding the thread on the bobbins Many of the parchment patterns used in making these laces are 200 or 300 years old and have been handed down from mother to daughter for many generations The bone bobbins on which the thread is wound are often elaborately carved, and the older specimens are greatly valued by collectors

mouthpieces and receivers of telephones contain a portion of shellac Huge quantities of it are used annually in electrical work, principally as a binder and insulator, and it goes into oilcloth, glue linoleum, cements, certain kinds of ink, shoe dressings, and varnishes for paper, and leather and furniture polishes Unlike Japanese lacquer, shellac varnish is not suited to withstand water, which turns it white

Shellac makes a smooth, glossy coating when properly applied, and is widely used on floors and other surfaces where a quick-drying, tough, hard finish is most commonly desired

In India, Burma, and Siam these little lac insects, in compact colonies of many thousands of females and a few males, attach themselves to the tender shoots of the fig and certain acacia trees, and suck the sap with their tiny beaks They give off through their pores a resinous substance which hardens when it meets the air, and forms a protective shell about the lac insect They afterwards become glued to the twig by this superfluous excretion, and after a time die, forming with their bodies little domes over their myriads of eggs Generation after generation dwells upon the same twig until it is enveloped in a coating often half an inch thick This substance, gathered and refined by the natives, is what we call shellac

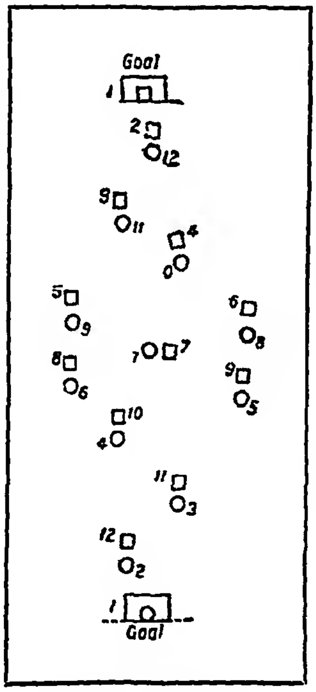
The natives cut twigs that are coated with these bumpy shells to a depth of an inch or more, or they scrape off the shells, and in this form lac is called stick-lac They break the stick-lac into little pieces with a stone hammer, and wash it thoroughly to remove the natural red colour, which in ancient times was used to dye cloth, and which is the true "lake" of the artist's colour-box Cheap aniline dyes have now partly replaced this primitive product (*See* Dyes)

The lac is now anything from a dark to a clear golden yellow, and this is raw "shellac" Native women and children spread it out on a drying mat and walk barefooted through it, turning it over and over in the sun to dry It is then poured into a narrow, sausage shaped cloth bag, which is twisted over a charcoal fire until the warm lac is strained through the cloth on the wetted stone floor There it is stretched into thin strips Sometimes it is dropped on the floor in little round cakes and stamped with the maker's initials In this form it is called "button lac" It is now ready to be packed and shipped to the western world, where more than half the total supply is marketed Besides being used with other ingredients in the products mentioned above, shellac itself is used for ornaments, being dyed in a large variety of colours

Two crops of stick-lac can be harvested each year The natives induce the insects to spread by tying a few twigs coated with lac eggs to other trees, where the young, upon hatching, immediately shift for themselves and start new colonies

Still another kind of lacquer—the kind that is used to produce a quick-drying finish on motor-cars and furniture, and is called cellulose-lacquer—is made from cotton that has gone through a complex series of chemical treatments (*See further* the article on Cellulose)

Lacrosse. (Pron lah-kros') Although, especially if you are a girl, you may have played this game in England, you would have to go to America to see it really played at its best For of all the games now played in the United States, there is probably none that is so truly American as the game of lacrosse Even before the discovery of America this was the favourite game of the most active tribes, who used it as a training for war As played by the Indians there were sometimes several hundred persons on a side The goals were placed half a mile or farther apart, the size of the playing area was almost limitless, and games sometimes lasted for many hours "Baggataway" is the name that the Ojibway Indians gave to the sport Lacrosse is the name given to it by the French colonists, since the stick used reminded them of the "crosse," or bishop's crosier They soon learned the game from the Indians and organized its rules



LACROSSE PLAN

Here is a plan of the field of play and the positions of the players These are (1) goalkeeper (2) point, (3) cover point (4) third man, (5) and (6) defence fields, (7) centre, (8) and (9) attack fields, (10) third home, (11) second home, (12) first home

The game became very popular among the white people, and was for many years the accepted national game of Canada In that country, as in the United States, it has been developed as a game of the most strenuous and exacting type It is a game that demands of the player great agility, speed, and endurance, also skill and dexterity in handling his "stick" The game was introduced into the British Isles in 1876, and achieved a fair measure of popularity, but is still played principally in girls' schools though an English Lacrosse Association exists

Lacrosse is played with a solid rubber ball $2\frac{1}{2}$ inches in diameter, which is caught and carried in or thrown from a "crosse," 3 to 4 feet long and not more than a foot across,

Sport & General

EXPENDING ENERGY AT LACROSSE

Here you see some English players at one of America's greatest games, lacrosse The "crosse" is the curiously shaped stick with a net which is used for this game, and their heavily-padded hands show that the players are prepared for a certain amount of injury

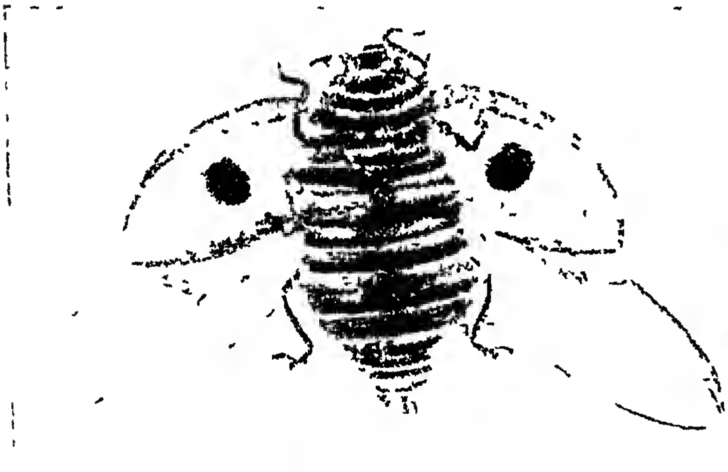
shaped like a fish-hook, with the curved part filled with a strong netting of raw-hide or catgut

The ball is caught and thrown from this netting, which extends half-way up the handle of the stick The player usually places one hand on the end of the stick and the other round the middle near the netting The playing field is about 120 yards long, with a goal 6 feet square, like a hockey goal, at each end

There are 12 players in a team, and the general purpose is by running with the ball, throwing it, or passing from one player to another to carry the ball to the vicinity of the opposing team's goal and throw it into the goal It is a foul for a player to touch the ball or another player with the hand—except for a goal-keeper, who may not throw the ball, but may stop it by hand A player may run with the ball, as far as possible, but opposing players may knock the ball out of his stick or run in front of him and "check" him with their bodies In lacrosse there is no "offside" rule as in other similar games, nor is the ball out of play when it has passed behind the goal-line outside the goal

Ladybird. You all know this little beetle, for it is one of the commonest of all our insects But you can never tell whether it is really a "lady" by just looking at it, for both male and female look exactly alike !

We have in England many species of ladybirds, all of them beetles of the family *Coccinellidae*, and many of them belonging to its chief genus, *Coccinella* Most people think of them as little, rounded, red-backed insects with black spots, but they vary a good deal really Some of them conform to the type, at least when they are normal , a good example is provided by the two-spot ladybird, which has ordinarily just the two spots, one on each wing-cover (*See* Beetles) But sometimes these two black spots are so large that the beetle looks as if it were all black, with two little red markings And at other times the spots can hardly be seen at all, and the beetle looks entirely red



THE LADYBIRD IS ONE OF MAN'S MOST USEFUL INSECT ALLIES

On the left is a single two-spot ladybird, photographed through a microscope, with its wings and legs all spread out The right-hand picture is of a bag full of ladybirds collected by an American entomologist for export to some locality where they will be used in fighting against a plant pest, probably one of the varieties of green-fly or similar creatures on which ladybirds feed The small sack must contain thousands of the tiny creatures

Photos J J Ward E N A

Besides the two-spotted species, our other very common ladybird is the seven-spotted, but there are others whose spots number as many as twenty-four Some of these are black with red spots, some are yellow with white spots, and one, the eyed ladybird, the biggest of all, has black spots, each surrounded with a yellowish ring, on its red wing-cases

All the ladybirds are most useful little creatures, for they spend their time, both as larvae and as adults, in devouring harmful pests, chiefly the aphids or green-fly which ruin our roses and similar species (*See* Aphis) So good are they at this that, in certain parts of the world, millions of ladybirds are collected and bred every year, and then sent by post to other parts where their enemies are doing particularly well

It is quite easy to collect the grown-up ladybirds, for in winter they assemble in great numbers, and take shelter behind the bark of trees, in cracks in the rocks, or frequently in the window frames or in nooks and crannies in the garden shed or outhouse Here they pass the winter, and, were it not for the man who comes round and collects them, they would certainly die off in large numbers in the cold weather But those which survive lay their eggs in the spring, and from these hatch the larvae

These larvae are funny little greyish or greenish creatures, soft and as unlike their parents as you could imagine, except in one thing and that is their diet For they get through a great number of aphids every day, seizing them in their strong jaws and sucking out their inside juices If you examine a spray of a rose-tree where there are lots of ladybirds at work you can see the empty skins of the aphids lying all around, with the ladybird grub happily eating away in the middle When it is full-grown, this grub turns into a rather soft, curious-looking pupa, attached to the surface of a leaf, often you can find these pupae on the leaf, and you can tell them by the way they flip to and fro if you touch them From the pupa emerges the adult ladybird, soft and pale in colour at first, but gradually hardening and then flying away In a year when there are large numbers of aphids the ladybirds breed very rapidly, and there may be several generations in one summer

Lady's Slipper. This is one of the rarest of all our British wild flowers, although at the same time it, and its relations, are among the most popular of all orchids for indoor cultivation Its name refers to the curious third petal of all the orchids of this genus, *Cypripedium*, instead of being, as in most common orchids, thrust forwards as a flat lip, it is curved round and inwards on both sides, to form a sort of vessel which suggests a miniature slipper

M H Crawford

ALL-TOO-RARE LADY'S SLIPPER

Here is one of our rarest flowers, but one that would be far commoner were it not for the greed of collectors who uproot specimens whenever they come across them It is a member of the orchid family, belonging to a genus which occurs in many other countries, the curious shape of the lip explains why it is called "lady's slipper"

The English lady's slipper was at one time less rare than it is now, being found in many localities in deep, moist woods in the limestone districts of the north of England But the greed of collectors began to reduce the plants, and they were wiped out in many places a few years ago Now there are only one or two spots in all England where the lady's slipper grows wild, and even there its existence is threatened The flowers of this species are green and yellow, on slender yet stiff stems, wrapped round with typical orchid leaves, smooth and pale green, with veins running lengthwise and parallel

In North America there are several species of lady's slipper, the best-known being the yellow lady's slipper, *C pubescens* This species

LADY'S TRESSES AND MANTLE

These are two of the most attractive of the flowers of later summer The lady's tresses, a member of the orchid tribe, is found on hills such as the South Downs, while the lady's mantle is also found in hilly districts, chiefly in the North

Photos E J Bedford H Bastin

has a pale yellow pouch, topped by long narrow twisted petals and sepals of greenish-yellow streaked with purple or brown, while converging toward the lip of the pouch are parallel purple lines, that guide the bees to the banquet of nectar within The pink lady's slipper, or moccasin flower (*Cypripedium acaule*), is one of the most charming of this genus Rivalling its exquisite beauty is the lovely "showy," or white, lady's slipper (*Cypripedium hirsutum*), which makes its home in the most inaccessible swampy places in rich mossy woods, where the flower-lover may find it from June until September

Two flowers which you may confuse, in name, with the lady's slipper are the lady's tresses and the lady's mantle The first of these is an orchid, though very different from those we have just been considering You may find it on the limestone hills indeed, but these will be the limestone of the south, namely, the chalk downs The lady's tresses (*Spiranthes autumnalis*) is a little plant, with a single, pale green flowering stem, on which the flowers are twisted and arranged spirally Among the long grass of the downs, you may often have difficulty in discovering it at all

The lady's mantle, however, is quite different To begin with, it is a member of a different natural order, and it is best known by its singularly lovely leaves These are round in general outline, lobed, with a finely and evenly serrated margin The flowers are very minute, greenish or yellowish in colour, devoid of petals, and very numerous, produced at the tops of quite tall stems This is a meadow plant, fond of a rather damp but sloping or hilly site Its scientific name is *Alchemilla vulgaris*

Lafayette, Marquis de (1757–1834) By birth Lafayette belonged to one of the old noble families of France When he was 19 and a captain in the French army the news arrived that the American colonies had declared their independence of England, France's ancient foe "At the first news of this quarrel," Lafayette afterwards wrote, "my heart was enrolled in it"

So he disobeyed the commands of his king and his angry father-in-law, purchased a ship, and after many difficulties sailed for America He offered to serve without pay, and Congress gave him the rank of major-general

Lafayette's services were of inestimable value Very important was his influence in inducing the French government to sign a treaty of alliance with the colonies, in 1778, without which they could not have won the war

Lafayette's love for liberty naturally led him to be one of the liberal French noblemen who

LAFAYETTE IN PRISON

Failing to stem the violence of the Jacobin French revolutionaries in 1792, Lafayette rode into the neutral territory of Liege, where he was seized and imprisoned by the Austrians He was released by Napoleon in 1797 This contemporary engraving shows the great patriot with his captors, who are riveting his shackles upon him

British Museum

favoured the Revolution of 1789 in his own country. On the day after the storming of the Bastille he was made commander-in-chief of the new National Guard organized to safeguard the Revolution. It was he who proposed for the Revolutionary armies the famous tricolour—"the red, white, and blue."

Lafayette rescued the queen from the mob of October 5, 1789, and issued orders to stop the king when he sought to flee to the hostile armies outside France. But gradually he became dismayed at the growing excesses of the Revolution. As the head of an army raised to defend France against Austria he planned to overthrow the Jacobins and support a limited monarchy. He was therefore proclaimed a traitor, and to escape arrest and the guillotine he fled to Belgium, where he was imprisoned by the Austrians until his release was obtained by Napoleon.

Lafayette took no part in public affairs until after Napoleon's overthrow. When the restored Bourbons attempted to restore the old absolutism he led the opposition, and in 1830 took part in his third revolution as commander of the army of National Guards that drove Charles X from France and placed on the throne Louis Philippe, "the citizen-king."

La Fontaine, JEAN DE (1621-1695). Strangely enough, you will probably know the famous fables of La Fontaine better in their native French than in an English translation, for they are among the few really popular books one meets at school. In them you may at first be surprised, not so much at their author's knowledge of humanity as at his keen perception of the realities of wild Nature. But when you read the tale of his life, this is more easily appreciated.

For La Fontaine was the son of the ranger of the forest of the duchy of Château-Thierry in Champagne, where he was born July 8, 1621; he succeeded to his father's rangership in 1647. From about 1660 he lived chiefly in Paris, where he died, April 13, 1695. It was comparatively late in life that La Fontaine turned to literature. Having secured an introduction to and a pension from Fouquet, the chief literary patron of the age in France, he began to write light verses and translate some of the less edifying classical works. But his first valuable work, the first volume of his "Contes," did not appear until 1664, though three years earlier he had produced the well-known "Élégie aux Nymphes," and in 1663 his "Voyage en Limousin." In 1668 came a second series of "Contes," and the first six books of the famous Fables which were to prove their author's most enduring monuments; a second series followed in 1679, a third in 1693.

Among his contemporaries the Fables were highly appreciated; La Fontaine passed from patron to patron and salon to salon with ever-increasing popularity, and in 1684 was elected a member of the French Academy. Unpractical and ingenuous, he had a genius for friendship, and with Molière, Racine, and Boileau formed a quartet notable in literary history.

LA FONTAINE'S FABLE OF KING LOG AND KING STORK

Here is an illustration, by J. J. Grandville, of La Fontaine's fable in which the stork is made king over the frogs. At first the old log in the foreground was their ruler, but as he did nothing they grumbled. When the fierce frog-eating stork came among them as their new king, however, they soon found that they were much worse off than before.

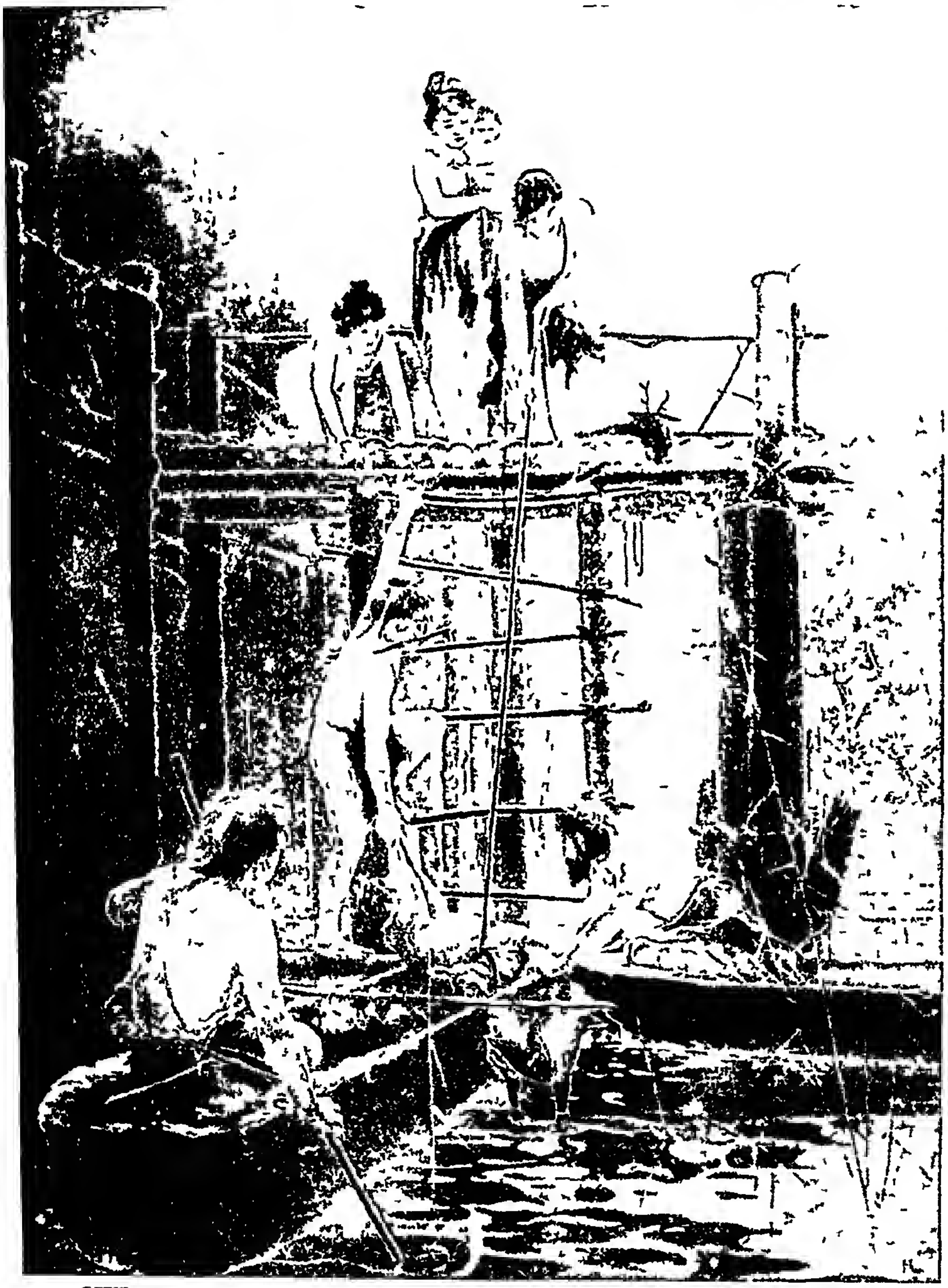
La Fontaine is, with Molière, the most widely read French writer of the 17th century. His Fables give equal delight to the child as fairy-tales, and to the man for their subtle reflections on human character; rendered in wonderfully easy and varied verse, they are regarded as among the glories of French literature. In them La Fontaine demonstrates a deep knowledge of Nature, and a deeper perception of the workings of human hearts and minds.

Lagerlof, OTTILIA LOUISA SELMA (Pron. lah'-ger-lēf) (Born 1858). The big forests, rough rocks, and merry rivers of south-western Sweden are poor in wealth, but they are rich in dreams. There, among tales and legends which the centuries have woven like mists about the lakes

and valleys, a delicate girl caught these dreams and by them changed the commonplace region into fairyland With an art all her own, Selma Lagerlof carries us into far fantastic worlds, where through strange eyes we catch glimpses which give daily happenings a meaning we quite miss in the busy workaday world She speaks to both head and heart Her fancy clothes facts in magic raiment, but never hides them

To make a school-book she called to her aid the elf of Northland myth Together they seated the boy Nils on the back of Morten Goosey-gander, and sent him with the wild geese to learn of the geography, plants, animals, industries, and folklore of his country, the result, "The Wonderful Adventures of Nils" (1907), became a children's classic, translated into seven languages before its tenth birthday

The life of Selma Lagerlof has almost the romance she gives to her stories As a little child she was unable to roam about the picturesque country surrounding the old homestead at Marbacka But by the fireside she listened to often-repeated weird tales with which the Northland abounds When not listening she read, or wrote wild strange stories for her own amusement At 33 she was an unknown schoolteacher Then her first published book, "Gosta Berling," brought her swift fame What the world calls life she had never known, what it calls doing she had never done, and yet within 20 years she was known and loved throughout Europe and America, not only as the winner of honours rarely bestowed upon women—among others the Nobel prize for literature—and as one of the foremost women writers of the age, but as a teller of rare fairy tales that are read by young and old alike All her books have been translated and published in English



SWISS LAKE-DWELLERS RETURN HOME AFTER THE HUNT

The lake-dwellers of Switzerland, living on shallow shores, built whole towns supported on many thousands of piles The houses were approached by bridges supported on piles, or the inhabitants reached them in dug-out canoes, some of them as much as 40 feet long In this picture the artist, Hippolyte Coutan, has reconstructed the scene when lake-dwellers were returning to their homes after a hunting expedition

Lake-dwellers. In prehistoric times nearly every lake in Switzerland, and many in the adjoining countries of central Europe, were inhabited by people to whom we usually give the name of lake-dwellers, because they lived in villages built above the water of the lakes

Such a village was composed of many huts (sometimes 200 or even 300) on a platform erected on a series of stout piles These piles were usually made from timber felled from forests on the lake shore The main idea of these villages was to render their inhabitants almost immune from any attack by enemies, human or otherwise Ordinary everyday life was spent on shore, in tending the herds, just as it is by Swiss peasants today

The origin of most of the Swiss lake-dwellings dates back to Stone Age times, but in others implements have been found of bronze and other metals Research has brought to light no fewer than fifty lake villages in the Lake of Neuchatel alone

The outstanding examples of lake villages in England are at Glastonbury and Meare in Somerset The rather similar *crannogs* in Ireland were built at a much later period (shortly before the Roman occupation), they were constructed on swampy ground, with a circle of piles making a solid platform to enclose a sort of artificial island

CHARLES LAMB AND HIS SISTER MARY

One of the most delightful of children's books is the "Tales from Shakespeare" of which Charles and Mary Lamb were the authors, Charles writing the stories of the tragedies and Mary those of the comedies Mary was 70 and Charles 59 when this picture by F S Cary was painted

National Portrait Gallery

Lakes. Technically, a lake is an inland body of water, larger than a pool or pond, and surrounded by land Actually, however, the name is given also to the widened parts of rivers, and to bodies of water which are in direct connexion with the sea, while other inland waters, like the Caspian and Dead Seas, are in reality lakes Like the Great Salt Lake of Utah, these seas are salty because they have no outlet to the ocean, but lose their water by evaporation, which leaves an excessive amount of mineral matter behind The Caspian Sea is the largest salt lake and inland body of water, while Lake Superior is the greatest freshwater lake

Lakes are found in any depression of the land surface where there is a sufficient supply of moisture These depressions may be due to various causes (1) Hundreds of thousands of lakes owe their origin to the great glaciers which in ancient times filled many river valleys with their deposits, or created new hollows by gouging out rock or distributing their debris unequally (2) Many lakes are formed by obstructions in river channels caused by lava flows, landslides, or tributaries that bring down sediment which blocks the main stream and forms a lake The abandoned "meanders" or windings of a river often become the sites of lakes (3) Occasionally the warping of the earth's crust creates depressions, as in the case of Lake Geneva, which was formed by the subsidence of part of the Alps (4) Sometimes "sink lakes" are formed by the sinking of land due to the washing away of underlying soluble rocks (5) Lakes are often found also in craters of inactive volcanoes

Many European lakes show signs of having been inhabited by prehistoric 'lake-dwellers," whose houses were built on wooden piles driven into the lake bottom along the shore (*See also* Lake dwellers, Physiography, and separate articles under the names of different lakes)

Lamb, Charles (1775–1834) As long as the English language is spoken or read, Charles Lamb will be remembered as one of the greatest and most lovable figures in its literature

He was born in the heart of London, in the Inner Temple, a rambling mass of old buildings filled with lawyers' offices and lodgings His father, whom he described as "of incorrigible and losing honesty," was a poor lawyer's clerk At the age of seven Charles was sent to Christ's Hospital, the famous "Bluecoat" school Here he met Samuel Taylor Coleridge, who became his life-long friend, and another important figure

in the literary world. Ten years later he became a clerk in the accountant's office in East India House, and here he remained until he retired on a pension 33 years later.

When he was 21 his beloved sister Mary fell a victim to the insanity that was hereditary in their family, and killed their mother. She was confined in an asylum, where she recovered temporarily, and upon her brother giving a solemn promise to care for her for the rest of her life, she was released. Thenceforth, Charles Lamb sacrificed everything for his sister. When her malady recurred, he would take her by the hand, and brother and sister would walk mournfully to the asylum. But in the intervals, which he called "between the acts," there was much that was cheerful and beautiful in their life. They wrote together the "Tales from Shakespeare," which have given pleasure to so many children.

Although he began his literary career by writing poetry, and first won distinction by his literary criticism, Charles Lamb's fame today rests chiefly on the essays written under the name of "Elia." In these essays he has taken the most trivial subjects, chosen apparently at random, and put into them his own whimsical, pathetic, quaintly humorous personality. Whether he writes "A Chapter on Ears," "Imperfect Sympathies," "The Praise of Chimney-Sweepers," "Old China," or a "Complaint on the Decay of Beggars," he says something worth while, and says it in his own inimitable way. Probably no essay in the English language has aroused more laughter than his "Dissertation on Roast Pig," and none is more full of pathos than his beautiful "Dream Children." Lamb's style has an old-fashioned flavour—a "self-pleasing quaintness"—due to his partiality for the older writers.

LAMPREYS BUILDING THEIR NEST

Most fishes do not make a nest, but the strange lamprey, having laid its eggs in a groove in the sandy bottom, covers them with a protective layer of stones. Here you see both parents at work, using their united efforts to shift a stone too large for one of them working alone.

Lamprey. There are gruesome stories that in the days of the Roman Empire wealthy masters sometimes punished their slaves by chopping them up and feeding them to lampreys in their fish-ponds. Whatever the truth of these stories, we know that lampreys were considered one of the greatest delicacies in Roman days, and that the millionaires of the time kept them alive in special ponds where they were carefully fattened for the banquet table. King Henry I of England is said to have died from "a surfeit of lampreys," but it was probably acute indigestion caused by a meal of them.

As far as the lamprey himself is concerned, the slave story does him no injustice. These eel-like fish, which inhabit today almost all oceans, seas, and rivers, fasten themselves with their cup-shaped mouths—for they have no proper jaws—to other fish and suck the blood of their hosts.

Salmon and shad are sometimes caught with lampreys attached to them, and much damage is done among valuable food fishes in this way. In return, the lampreys are taken in large numbers to be used as bait for cod and turbot. Their skeleton is of gristle, and for this reason they are classed among the lower fish families.

There are two principal species, the sea lamprey, *Petromyzon marinus*, and the river lamprey, *Petromyzon fluviatilis*.

On account of the shape of their mouths (*see above*) they are classed as *Cyclostomata* or "wheel-mouths."

Lamps AND LIGHTING. Torches and camp fires gave Man his first way to light the darkness and are today the only light of some primitive peoples. The Shetland Islanders used to make a torch by sticking a wick in the throat of a fat storm-petrel, and the Indians of the North Pacific coast made similar use of a little dried

fat smelt called the candle-fish The lamp of the cave-dweller, by the light of which he scratched strange drawings on the cave walls, was made of an animal's skull, a sea shell, or a hollowed stone With a rude wick of moss, vegetable fibre, or rushes, it burned animal fat or fish oil This type of lamp the Eskimos and some Laplanders use today

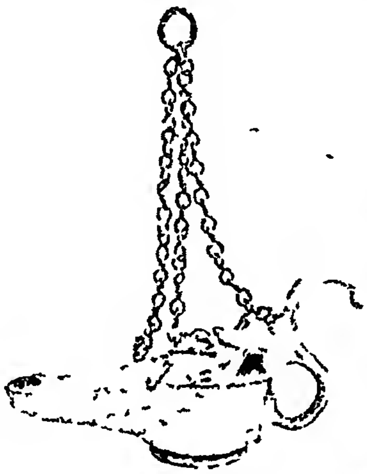
Many well-wrought terra-cotta lamps have been found in long-buried cities in Mesopotamia, some dating to 7000 or 8000 B C The oldest known metal lamps, made of bronze by prehistoric lake dwellers, have been found in Swiss lakes The traditional "lamp of learning" of ancient Greece and Rome was a shallow round or oval dish of terra-cotta or metal, with a handle at one end and a spout for a cloth or tow wick at the other As skill increased, the potters made terra-cotta lamps with solid tops

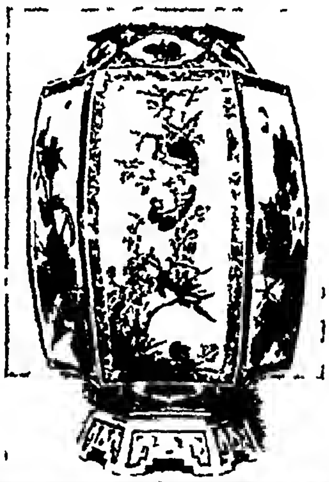
In the 18th century Aime Argand, a Swiss chemist, revolutionized lamps by placing a flat wick around a hollow tube, allowing air to reach the centre of the flame With more air and a better draught, the flame burned more carbon and gave less smoke By adding a glass chimney Argand made the lamp completely smokeless He was granted a French patent on this improvement in 1784

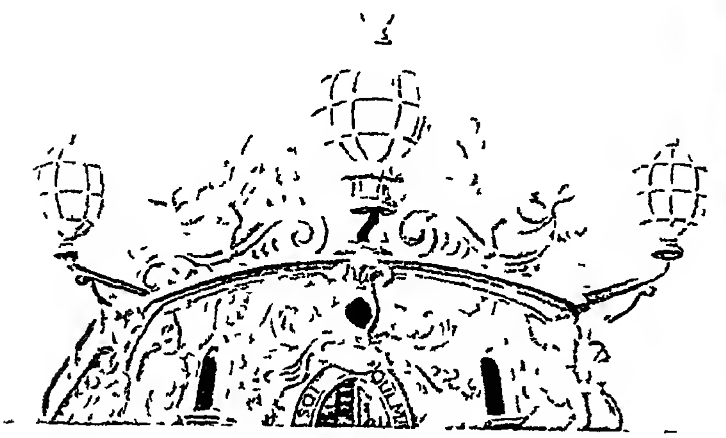
Best-known of the many modified Argand lamps is the "student's lamp" This has the oil in a raised tank flowing by gravity to the wick The safety-lamp for the use of miners, devised and made public in 1815 by Sir Humphry Davy, was another very simple device, but one which has saved countless lives This lamp, which with slight modification is still used in mines, is merely a common lamp with a wire-gauze cylinder about the flame to prevent the heat from igniting explosive gases

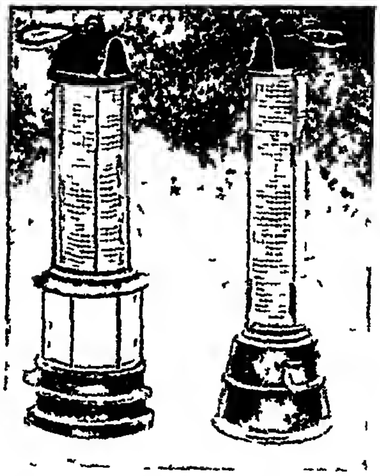
Until about 1845 lamps burned animal fats, whale, fish, and vegetable oils Whale oil was burned in the lanterns of lighthouses Camphine, made from turpentine, was among the first substitutes for animal oils, but its tendency to explode kept it from coming into general use Paraffin, safe and cheap, came into general use about 1860

Lanterns, portable lamps to be carried in the wind, were used in ancient times at the head of marching armies, in religious rites, and by soothsayers in their auguries Before the introduction of the glass chimney a lantern was usually a candle shielded by a metal guard with holes cut through to shed light In the 16th and 17th centuries horn replaced the metal guard, hence came the old spelling "lanthorn" Later oil-burning lanterns were used, with glass chimneys to shield the flame









NEW LAMPS AND OLD FOR USE AND ORNAMENT

The top left illustration is of an ancient Roman lamp with chains for suspending it from a candelabrum The shoe-shaped part was filled with oil from which a wick projected at the "toe" Top right is a Chinese egg-shell porcelain lantern of the reign of K'ang Hsi (c 1680) At lower left is the stern of a 17th-century ship with its three lanterns The bottom right picture shows a pair of Davy lamps used by miners, the left-hand one, in the newer style, having glass around the flame

Photos top left British Museum top right Victoria & Albert Museum


DISMAL ROOM OF A 'DARK' AGE CONTRASTS WITH MODERN LIGHTING

One of the most remarkable achievements of modern inventors is the improvement in house-lighting It is less than a hundred and fifty years since the first experiments in house-lighting were made, and until then candles were used in most houses The photograph on the left shows a cut-glass chandelier holding many sconces for candles, which until the early years of the 19th century would have been the only illuminant for such a large room as this On the right is a modern children's play-room, in which two parchment shaded lamps diffuse a light hardly distinguishable from daylight

Photos, left Mansell right J S Murray

Railwaymen still signal at night with oil lanterns as well as electric The dark lantern, or "bull's eye," has a convex lens to concentrate the light A sliding shutter may cover the lens

Most used today of all the old lights is the candle (*q v*) The candlestick has long been a handsome ornament The Greeks and Romans made beautiful candelabra, and in Europe artists wrought fine designs in iron, bronze, and copper for candlesticks In the 17th and 18th centuries candlesticks of silver, silver plate, and Sheffield plate, as well as of china and glass, glittered on elegant tables

Brighter light became more available with the introduction of gas at the beginning of the 19th century Its use spread rapidly after the development of the Welsbach mantle, and it was only slowly replaced by the electric lamp

The first glaring little electric light, hanging from the end of a green cord, was far from lovely People have since learned how to make electric lighting beautiful In public buildings indirect lighting, produced by bowl-shaped reflectors or opaque globes, is favoured

In the home each room should be lighted according to its use The living-room is best lighted with several lamps conveniently placed, the dining-room, perhaps, by a chandelier Kitchen and bathroom need special illumination

Until the introduction of cheap glass for windows, little sunlight found its way into houses, and even after glass became available windows were few in some countries because a tax was put on them In medieval times windows in the poorer sort of houses were made of oiled paper

Not only glass, but semi-transparent stone, thin slabs of marble, and shells set in stone frames have served as windows Pierced stone and grilles of wrought metal have served to admit light while repelling intruders The first glass windows were probably those of ancient Rome, made of small pieces of glass set in bronze frames Small-paned windows, with panes joined by strips of lead, were the first glazed windows in Europe because the glass-makers did not then know how to make large sheets of glass

People today understand more clearly the importance of sunlight indoors Sunlight is the strongest of disinfectants, and only properly-lighted rooms offer efficient working conditions Architects estimate that the window space in home or office building should be equal to about

20 per cent of the floor space The modern light, any house or room, with plenty of windows and well-placed electric lights, is a delightful contrast to the dark dens of the "good old days"

Lanarkshire. The fact that Glasgow (*q v*) is situated within its borders is in itself sufficient to distinguish this county as one of the most important in Scotland from an industrial and commercial point of view

The prosperity of the county, which has an area of 879 square miles, is founded largely on its extensive coal-fields and iron-ore deposits This circumstance led to Lanarkshire becoming, as it is now, the centre of the Scottish iron and steel industry, with numerous blast-furnaces, and a considerable number of steel-works and iron-foundries, furnishing employment to many thousands Agriculture is another important industry, with Lanark, the county town (population, 6,000), as the chief market-town New Lanark was the scene of Robert Owen's experiment in "benevolent capitalism," where he ran his cotton mill Fruit-farming is another profitable pursuit, the headquarters being at Carluke, where many great jam factories have been erected

This county is the most populous in Scotland, containing, besides those already mentioned, many important industrial towns, such as Motherwell, Coatbridge, Airdrie, Hamilton, and Wishaw The most important river is the Clyde (*q v*), which the enterprise of the citizens of Glasgow has transformed from a shallow, muddy creek into one of the leading waterways of the British Isles There is much picturesque scenery in Clydesdale, which is also noted for its breed of horses The population of Lanarkshire is about 1,586,000

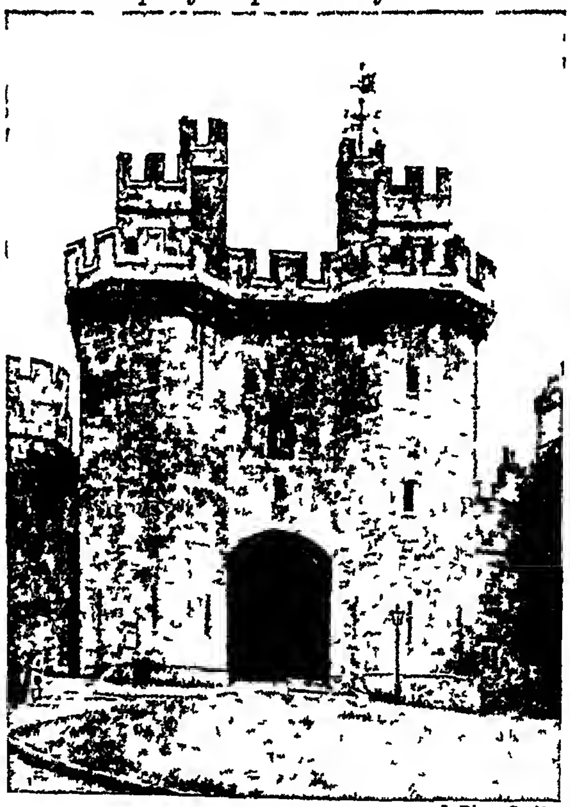
Lancashire. The great cotton industry of Lancashire, although it has met with severe competition, particularly from Japan, since the War of 1914-18, is still an important prop of England's supremacy as a manufacturing country In this county, which has an area of 1,860 square miles, the modern factory system had its birth, and here its national importance appears most impressive Lancashire is also known for the very distinctive dialect spoken by its inhabitants

There are numerous large cities and important manufacturing towns within the county, including Liverpool (*q v*), Manchester (*q v*)—connected with Liverpool and the Irish Sea by the Manchester Ship Canal—Accrington, Blackburn, Blackpool (the greatest pleasure resort and amusement centre in the North), Bolton, Bootle, Burnley, Bury, Preston, Rochdale, Oldham, St Helens, Salford, Southport, Widnes, Wigan, and Lancaster The last is the county town, with a population of 43,000

In the southern part of the county extensive coal-fields are actively worked, while in the northern Furness district beyond Morecambe Bay the iron-ore mines led to the growth of the modern industrial town of Barrow-in-Furness (*q v*) In the north are mountains of the Cumbrian group, where Coniston Old Man reaches to 2630 feet, and in the centre some of the heights of the Pennine Chain, where Pendle Hill, 1800 feet, is the highest point Coniston Lake is included in the county The level areas are in the south and along the coastline, which is broken by Morecambe Bay The largest rivers are the Mersey, on the estuary of which Liverpool lies, the Ribble and the Lune The population of the county reaches a total of 5,039,000 persons

Landor, Walter Savage (1775-1864) This gifted English poet and man of letters was born at Ipsley Court, Warwickshire, on January 30, 1775, and died at Florence, September 17, 1864 He came of a wealthy family, and probably inheritance and easy circumstances contributed to the uneven temper and pride which were so prominent in his character

He was a strange mixture Endowed with great intellectual gifts, and a distinguished classical scholar, he was expelled from Rugby School, and in after life contrived to quarrel with and openly despised many of the writers



J Dixon Scott

LANCASTER CASTLE GATE

The Gateway Tower, mainly built by John of Gaunt, is one of the few really old parts of Lancaster Castle This latter is the most important building in Lancashire's county town

of his time Yet to others he was generous and devoted, amongst the friends whom he valued most being Robert Southey

Landor's writings have little interest today, except to scholars and cultured people who delight in literary style He assuredly did not write for the great reading public, and was not in any sense a popular writer Indeed, the average man and woman would find his writings boring or dull On the other hand, Landor's prose, as well as his verse, is often characterized by a singular sweetness and perfectly balanced literary expression

Landor's greatest achievement is his "Imaginary Conversations" These contain nearly one hundred and fifty dialogues put into the mouths of the great figures in history

Landseer, Sir Edwin (1802-1873) "Where is my curly-headed dog boy?" the teacher of the Royal Academy school used to ask, when he missed the lad Landseer from his classes The answer would be "At the Zoo," for this boy divided his time between the two places, and at either was sure to be found studying animals or making pictures of them Dogs were his favourites, and his first drawing to be engraved and published was of a great St Bernard "Fighting Dogs Getting Wind" was the first of his paintings to bring him fame His London studio was full of paintings of dogs, big and little, fierce and gentle, all so real that visitors would almost be deceived into thinking them alive

Although he was especially fond of dogs, Landseer loved all animals Once in Scotland he was taken deer-hunting, and as he and his host lay in ambush a splendid stag appeared While the host in courtesy waited for Landseer to make the shot, the artist dropped his gun, and, pulling a pencil and pad from his pocket, began making a sketch of the magnificent animal

Landseer could draw rapidly and easily A story is told of how he once drew a stag's head with his right hand, at the same time drawing a horse's head with his left Although lacking confirmation, the probability is that the story is quite true, for he could draw almost equally well with both hands From boyhood, when at the age of 11 years his drawings won a silver palette from the Society of Arts in London, Landseer's life-story is of one success after another He was early made a member of the Royal Academy, he enjoyed the patronage and friendship of Queen Victoria, he was knighted, and the presidency of the Royal Academy was offered to him Upon his death he was buried in St Paul's Cathedral

Photo Mansell

'DIGNITY AND IMPUDENCE'

This is Sir Edwin Landseer's most famous painting, and it now hangs in the Tate Gallery, London Though once the most popular of all works of art, Landseer's animal paintings are today little admired, his portraits being more esteemed

Of his many dog pictures, "Dignity and Impudence" is perhaps the best-known His stags were quite as popular as his dogs, and of these the "Monarch of the Glen" was favourite

Besides his pictures of animals Sir Edwin Landseer painted many portraits of celebrated people The sculptures of the well-known lions in Trafalgar Square are also his work

Language and Literature We know little of how the first words grew, whether people imitated sounds of water and wind and beasts, or by what means they assigned a certain significance to an uttered sound But, like many things that Man has made, language has grown with the human race, changed with its history, its tastes, and its fancies, and accurately reflected the image of the people who made and used it Primitive people, with vague minds, have a simple, blunt tool of language A crude, dull person uses a language of the same quality as his mind Clever races, on the other hand, with quick, keen minds, develop a language of subtlety and sharpness

History Enshrined in Language

Languages live, grow, and die, as do people They record the march of history The conquering Romans spread their speech throughout their empire, so that it lives today in French, Italian, Spanish, Portuguese, and Rumanian Many a foreigner today twists his tongue round the strange and difficult language of the English because those enterprising people have spread

their control far abroad Americans speak English rather than French or Spanish, because the vast majority of the colonists who settled North America came from the British Isles

In a world tied ever more tightly together by railways, aeroplanes, steamships, cables, telegraphs, and telephones, language barriers between peoples become an increasing nuisance People have tried to create artificial languages, easy to learn, without the cranky ways of a natural tongue, for the use of all nations But an artificial language, like a wax doll, lacks life and strength and conviction

All civilized people have made an art of language Only a great race, producing writers of spiritual depth and possessing a language capable of nuances and harmonies, can produce a great literature Poems, plays, and tales take on the colour of their own age, just as do architecture and painting A rough age never produces elegant literature, nor a shallow era anything but trash Intellectual movements, trends in taste such as classicism, romanticism, and the like, sweep from one country to another in all the arts, like wind over a wheat field Language and literature are the best record of the growth of human intelligence

Lansbury, GEORGE (born 1859) In the field of modern politics, all too frequently one hears of men who are prepared to make the most wonderful promises of the things they will do if they get into power and then, when the time comes, rather than offend their enemies, or jeopardize their position, they decide after all to do only part of what they said—or perhaps, making some excuse or other, they shelve it altogether This is especially the case with men who set out with great ideas about alleviating the sufferings of the poorer members of the community, and giving " the people " more opportunities for enjoyment In our modern politics, a man who stands out as an exception to this unfortunate rule is George Lansbury

Born February 21, 1859, the son of an Oxford tradesman, he tried his hand at many trades, visiting Australia, 1884–85, and on his return joining his father-in-law in business as a printer Lansbury was elected poor law guardian for Bow and Bromley, 1891, in 1903 to the Poplar borough council and later to the L C C Having sat as Labour member for Bow and Bromley for two years, he resigned his seat in Parliament in 1912 to contest it again as a supporter of woman's suffrage, but was defeated, remaining outside the House until 1922, when he was re-elected He edited the "Daily Herald" 1914–1922

First Commissioner of Works in the second Labour government of 1929–31, he was responsible for the institution of bathing facilities at the Serpentine, Hyde Park (known popularly as the " Lansbury Lido '), as well as for the institution of playgrounds, especially for very young children, in other parks This was in spite of considerable opposition from all sides In these and in other ways he did much by precept and example to alleviate the conditions of the poor all over London, as well as in his own constituency After the Labour defeat at the general election of 1931 he was elected leader of the party in the House of Commons, retiring from this office in 1935

Thereafter Lansbury toured the Continent of Europe, lecturing in the cause of peace In this connexion he paid visits to Mussolini and Hitler, as well as to many other men of importance He still continued his work at home by serving, as he long had done, on numerous committees but it is as the founder of the Serpentine " Lido " and other playgrounds that he will be popularly remembered

Lapland. If you should visit the frozen lands in the extreme north of Norway Sweden, Finland, and western Russia, you would see, on a Sunday, black dots moving along down the steep hill tracks On closer view they would turn out to be squat, bow-legged people, just about

Wide World Photos

HAPPY PEOPLE OF LAPLAND

The Lapps who inhabit the extreme north of Norway Sweden, Finland, and Russia, live by hunting and keep great herds of reindeer, some of which, like the one in the photograph, are broken in for use as draught animals This Lapp family is better dressed than are the majority of Lapps

five feet high, travelling to church on skis or driving there—sometimes as much as 100 miles —in "pulkas," their queer reindeer sledges that look like birch-bark canoes. These are Lapps, the shortest people in Europe, who live—about 30,000 of them—in a dreary Arctic region with a long sunless winter. The region over which they roam is called Lapland, but it has no independent political existence.

The Lapps are of Asiatic origin and speak a language something like that of the Finns. They are an honest, healthy, contented little people, who wash their flat Mongolian faces only on festive occasions, and who live with their dogs in tents or earth-covered huts. Most of them spend their lives in fishing, hunting, and tending their many reindeer that feed on mosses and lichens. A rich Lapp may own perhaps 2,000 reindeer, for these are the people's chief resource, supplying them with meat, milk, and clothing, and furnishing the only means of transportation. There are nearly half a million reindeer in Lapland altogether. The true Lapps lead a semi-nomadic life because of the need of fresh pastures for their herds, pasturage once closely cropped is not used again for some ten years. The fishing Lapps, however, live a more settled life.

H Bastin

THE EVER-GRACEFUL LARCH

So fine are the needles of the larch that even in summer, when this photograph was taken, the tree has a light and airy appearance. Unlike most conifers, it loses its leaves in winter, but even then its spire-like profile and the upward trend of its branches make it easy to recognize

Larch. This tree is peculiar among conifers in that its needle-like leaves are shed each year. There are about eight species of the larch, widely distributed through the Northern Hemisphere. The common larch (*Larix europea*), found in the mountainous regions of Europe, is a beautiful tree reaching a height of 80 to 130 feet. It flourishes also in Asia, where it grows in higher latitudes than in Europe. It is ornamental and graceful, its slenderness of form being accentuated by the dainty thread-like character of its pale green foliage, the leaves are arranged in tufts on all but the youngest shoots. In spring they are a most beautiful pale green, and together with the crimson female and yellowish male flowers and grey-brown old cones make the larch trees a lovely sight. The mature cones are small, with papery scales, which distinguish them from those of any other conifer.

The timber of the larch is noted for its toughness, and is resinous and durable, being useful for railway sleepers, pit-props, and shipbuilding.

As the tree grows quickly, and its straightness is accentuated by crowding in plantations, it is very valuable where a quick return is needed by the grower. For this reason it has been much planted in Britain by the Forestry Commission, as well as by private enterprise. Another species which is preferred in some places is the Japanese larch (*L kaempferi*), which you can tell from the common species by the faintly blue-green look of the leaves. American species include the American larch, tamarack, or hackmatack (*L laricina*), and the western larch (*L occidentalis*), which is the largest species, reaching 250 feet in height. The larches are very important commercially, for turpentine as well as timber.

Lark. The bird that "at heaven's gate sings" is an unpretentious little brown fellow, but he and the rest of his family, in spite of their plain appearance, are renowned as songsters.

Larks are almost exclusively birds of the Old World, and especially its more temperate countries. There are about 100 species, usually streaked brown above and white and brown beneath, many are crested. They nest on the ground and feed on seeds and insects. The only species found in America is the horned lark. Like its more famous cousin, the skylark of Europe, it sings its wild, joyous song on the wing.

The skylark, *Alauda arvensis*, is the poet's bird. "On the wings of song" he soars until he fades from view and only his melody, wafted downward, tells of his onward flight. Then, still fluttering and singing, he comes again into sight, swinging in wide aerial circuits until his song ended, he drops to the earth, where among the grasses his little mate is sitting on the nest. This is usually a simple affair of fine

grasses, well concealed among the herbage, or even partially under a stone or a tuft of grass, and containing from three to five eggs, thickly speckled with grey-brown markings Several broods of young may be reared in a season, for these, being defenceless and on the ground, are very liable to sudden death during their first few days of existence In winter our resident larks are augmented by vast flocks from farther north which assemble chiefly on the coast of East Anglia

Besides the skylark, which you can hear at almost any time of the year and which we all know so well, we have in Britain another species, the less common woodlark (*Lullula arborea*), which likes rather open woodlands and which has also a most beautiful song The "titlark," a bird you may confuse with the skylark, is actually the meadow-pipit (*See* Pipit)

I M Thompson

FATHER LARK SAYS 'DINNER IS READY'

The skylark is one of our best-known birds, although most people know his voice better than his appearance Here is a cock lark—you can tell him by his crest—just arrived back at the nest with a beakful of caterpillars—dinner for his hungry brood The nest, as you see, is simply constructed of grass, harmonizing well with its surroundings

Larkspur. These charming clustered blue-and-purple blossoms, which you probably know also under their botanical name, *Delphinium*, add much by their beauty to the bright summer pageant of our flowers From June until August the "tall larkspur," growing to a height of 5 feet, waves its plumy wands of purplish-blue in the gardens of England The blossoms with their long up-tilted spurs look like lovely little fairies poised for flight They rest lightly on the ends of tiny stems that crowd close together on a central stalk, which lower down bears also large, deeply divided leaves

R A Malby

A LARKSPUR

This is the plant which we know as a delphinium in the garden although its old English name of larkspur is surely more attractive It belongs to the buttercup family

There are both annual and perennial species of larkspur, found in both Old and New Worlds Among the former are the branching larkspur and the lovely rocket larkspur of Switzerland The perennials, however, are the most gorgeous members of the genus

The structure of these flowers is interesting, for there are five petal-like sepals with the rear one prolonged into a slender curved spur, and two united petals with spurs that project into the spur of the sepals In spite of this curious arrangement, the larkspur is a member of the buttercup family, *Ranunculaceae*

Larva. This term is applied to the young of many animals when, on hatching from the egg, they are markedly different from the adult It is especially applied to insects, most of which hatch as larvae, but frogs and toads also have a larval stage in the fish-like "tadpoles" which hatch from the eggs, and many fish have a so-called larval stage, such, for example, as the "leptocephalus" larva of the eel

The larvae of beetles are usually known as grubs, of flies, as maggots, of butterflies and moths, as caterpillars The true larva must go through another stage, called the *pupa*, before it becomes a fully-developed insect Larvae live only to eat and grow often working untold harm to vegetation As the larva grows it sheds its skin or moults The caterpillar, for instance, moults four or five times, other larvae as often as 20 times before they are full-grown (*See* Butterflies and Moths Caterpillars Insects)

La Salle, RENE ROBERT CAVELIER SIEUR DE (1643–1687) The son of a rich merchant of Rouen in Normandy, La Salle had forsaken his Jesuit training to emigrate in his 24th year to Canada There he heard Indian tales of a great river called the Ohio, and in 1669 set out in search of it, by way of the St Lawrence and Lake Erie, tracing its course certainly as far as the rapids at Louisville In 1671 he reached the

Illinois River before turning back Early in August, 1679, he launched on the Niagara River, above the Falls, a little vessel, called the Griffin, which he hoped would bear him through the lakes to the Chicago portage, but the vessel was lost

In February, 1682, La Salle's canoe floated out from the Illinois into the waters of the Mississippi, but floating ice for a time delayed the voyagers Their course led them past the mouth of the Missouri and past the Ohio Finally, early in April, they emerged on the broad bosom of the great Gulf of Mexico

Landing, La Salle took possession of the country for France He erected a column bearing the arms of France and also a leaden plate, on which was inscribed a record of his discovery and some Latin sentences telling that all the land drained by the Mississippi and Ohio rivers was claimed for the French After his return to Quebec he resolved to go to France and get men for a colony which he wished to plant at the Mississippi mouth

Having succeeded in France in fitting out this colony, he sailed with four vessels early in July, 1684, in search of the Mississippi River by way of the Gulf of Mexico Bad fortune, however, caused him to miss its mouth and land in Spanish territory, at Matagorda Bay, 400 miles to the west While attempting to make his way back overland to Canada for supplies, he was assassinated on the bank of Trinity River, Texas, in March, 1687, by his followers

Wrapped in his splendid dream, reserved and haughty, he gave his confidence to no one but his faithful follower Henri de Tonty His masterful ways were resented by his other white followers He had powerful enemies in Canada and France, but before his death he did a great work He had discovered the Ohio River, and probably the Illinois, and he had traced the Mississippi from its upper waters to its mouth

The MOTHER-TONGUE *of* CIVILIZATION

Far from Rome—and for many centuries after her downfall—Latin was the speech of learned men of all races, and, in debased form, of the multitude also In it were written the majority of the "classics"

Latin LANGUAGE AND LITERATURE The idea of an international language spoken by all the peoples of Christendom seems visionary and Utopian to us But such a language really existed for many centuries—from just before the dawn of the Christian era almost to our own times This world language was Latin It began its world-wide career as a conquering tongue by following the victorious Roman legions over Europe, Asia and Africa, until at length it became the speech of civilization from the British Isles to the Persian Gulf

EARLY HOME OF LATIN BOOKS

It was at Ephesus that the first large Roman library was founded, in 39 B C, and later most of the larger towns had them There was a central reading-room (on the lines shown above), with smaller rooms and manuscript-presses around it

Reconstruction by Niemann

In the mouths of the unlearned and careless majority, the Latin of everyday life kept steadily changing in pronunciation, grammar, and vocabulary Thus various dialects grew up in different localities, which in the course of a few centuries developed into the group of related tongues called the "Romance languages" But literary Latin, which remained the language of religious and political life as well as the language of scholarship, underwent little change

In the Middle Ages scholars, priests, and statesmen could travel the length of Europe without learning the languages of the various countries, since in every community there were sure to be men of learning who talked Latin, and state documents and works of scholarship were written exclusively in Latin

Many English writers have written in Latin, for they knew that this would render their books accessible to a wider public than if in English Bede, in the 8th century, wrote his famous History in Latin, Roger Bacon, in the 13th century composed all his works in Latin Francis Bacon and William Camden, in the 16th century, employed Latin in some of their books, and in the following century, when

Sir Isaac Newton described his great discoveries to the world, he did so in the Latin tongue

Even today Latin is something of a world language, though in a different way In the sciences that divide and describe Nature, such as botany and zoology and anatomy, Latin terms are used—for example, *Rosa canina* for the dog-rose, or *Felis leo* for the lion—in order that they may be understood by scientists of all nationalities

One third of the English that we write is Latin, and we can hardly speak a sentence without using some such words as "mile," "city," "army," "justice," "religion," and thousands of others that we have inherited from the ancient Romans (*See* English Language) In the Romance languages of Europe—Italian, French, Spanish, and the like—the proportion of Latin words is higher than in English

In the Indo-European family of languages, Latin is a younger sister to Sanskrit and Greek (*See* Philology) At the time when Greece was creating poetry for all time, Latin was still only a dialect spoken by a few tribes in the vicinity of Rome And it was not until the 3rd century B C that it had been planted throughout Italy, superseding the other Italic dialects, and not until the 1st century that it had been developed into a superb literary language, a marvellous instrument for prose and poetry

VIRGIL INSPIRED BY THE MUSES

The Aeneid is without question the greatest glory of Latin poetry, and Virgil was always the most highly regarded of Roman poets, both in his own day and since This mosaic from a Roman villa at Carthage shows him with the manuscript of the Aeneid on his knee, with Clio (muse of history) and Melpomene (muse of tragic poetry) standing beside him

Bardo Museum Tunis from Monuments Piot

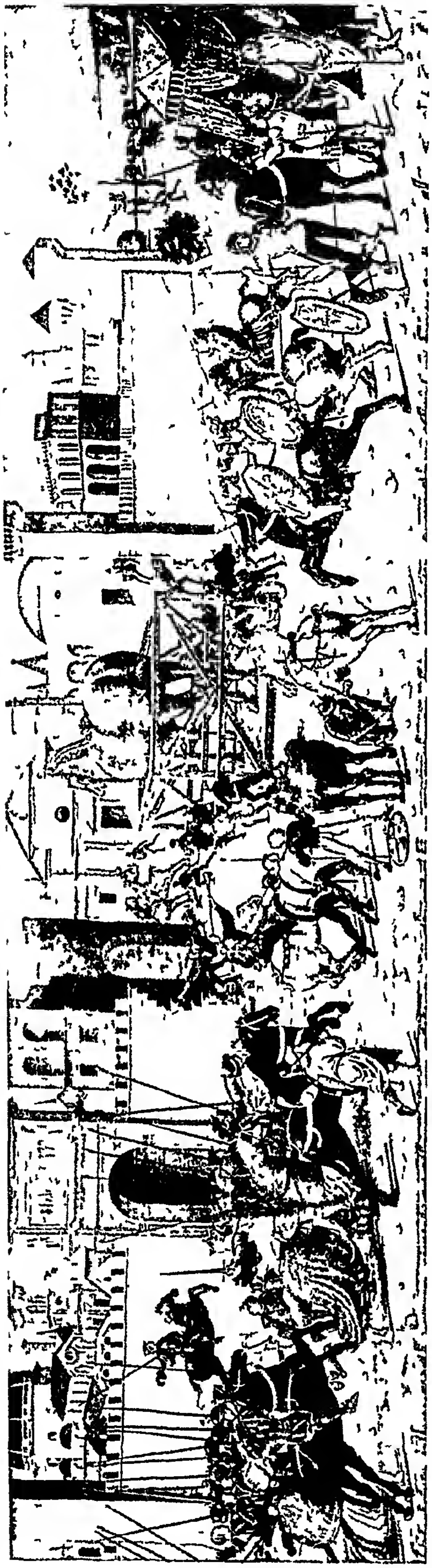
Just what Latin literature might have become if it had been left to itself, as the Greek was, we shall never know Certainly it would have been very different Before the invasion of Greek culture that followed the Roman capture of Tarentum, the greatest of the Greek colonies in southern Italy (272 B C), the Romans had developed a metre of their own and the beginnings of a literary form Their so called Saturnian verse was apparently based upon accent, as our verse forms are, and was a vigorous, rough-and-ready line capable of adaptation to a variety of poetical purposes The Greek measures, which Latin afterwards imitated, were based not on accent but upon long and short syllables

In the languages of many uncivilized peoples nowadays the first written book is a translation of the Bible In Rome the first book seems to have been a translation of the Odyssey This was made in the latter half of the 3rd century B C by a Greek, Livius Andronicus, who was brought to Rome as a slave after the capture of Tarentum Andronicus translated some Greek plays as well The next poet, Gnaeus Naevius (died about 200 B C), went on translating or imitating Greek drama, often using subjects from Roman history and introducing allusions to contemporary politics He made use also of the pattern given by Andronicus's Odyssey to write an epic of the First Punic War Thus, from the very beginnings, Roman literature was based on Greek models

On this foundation Quintus Ennius (239–169 B C), the most important Roman writer before the age of Cicero, reared the stately edifice of his "Annales"—a tremendous epic history of the Roman state, which unfortunately is known to us by only a few fragments In this poem Ennius remoulded the still rude and clumsy Latin to fit the stately flow of the Greek hexameter verse form, thus influencing the whole later history of the language

The first Latin writer whose works have survived in any considerable body is Titus Maccius Plautus (c 251–184 B C), the greatest comic dramatist of Rome His plots—which he borrowed from the later Greek comic poets—have in turn furnished a rich mine for later playwrights, including Shakespeare and Moliere

Though Plautus got the substance of his plots and characters from Greek sources, his manner and spirit were essentially Roman His great successor Terence, who was born about the year 194 B C , devoted himself to



A FAMOUS INCIDENT IN VIRGIL'S STORY OF THE TROJAN WAR

In his Aeneid Virgil, like Homer in the Iliad, relates the history of the Trojan War, and describes the cunning trick by which the Greeks smuggled a party of picked warriors into Troy in the body of a wooden horse In this medieval Italian painting of the entry of the horse into Troy the artist has given the figures costumes like those of his own time although the war took place thousands of years before

Fitzwilliam Museum Cambridge photo Mansell

copying his Greek originals more closely His merit is that he thus brought into Roman literature the Greek standards of elegance, artistic perfection and moderation His six plays, which all survive, have served as models of classical perfection to every generation of playwrights since

In addition to these poets, we have crusty old Cato the Censor (234–149 B C), who was the first writer of prose history in Rome to use his native tongue, and whose published speeches Cicero sincerely admired, and Lucilius (about 180–103 B C), who wrote the first satires in the modern sense of witty social criticism

Latin Literature in Its Prime

The Golden Age, as we call the period when Latin literature reached its greatest splendour covers about a century (80 B C–A D 14), from the beginning of Cicero's rise as an orator to the death of the Emperor Augustus, under whose patronage arts and letters flourished as never before in Italy Cicero brought Latin prose as an instrument for oratorical, philosophical, literary, and epistolary expression to such a pitch of perfection that the adjective "Ciceronian" is a synonym for "classically perfect," "polished" Different from, but not inferior to, the stately sonorous periods of Cicero was the simple straightforward style of Caesar, whose commentaries on the Gallic War, recording his campaign in Gaul, and on the Civil War, describing his actions in Italy itself, will ever remain models of prose narration

The other chief writers of the Ciceronian period are Sallust, Lucretius, and Catullus Sallust (86–34 B C) is placed in the front rank of Roman historians by the accounts he has left us of the Catiline conspiracy and the Jugurthine war The philosophical epic *De rerum natura* ("Concerning the Nature of Things") of Lucretius (c 98–55 B C) is, perhaps, the most original and certainly, next to the Aeneid, the greatest poem in Latin Catullus (c 84–54) was the greatest lyric poet of ancient Rome, and one of the greatest of all time Like Burns and Heine in later days, he wrote love poems that bring the joy and pain of the passing moment vividly before the reader

With these names we pass from the literature of the Roman Republic to that of the Empire First of these both in time and genius was Virgil (Publius Vergilius Maro), 70–19 B C His great national epic, the "Aeneid," is one of the supreme masterpieces of the world, yielding place only to the matchless Iliad and Odyssey In his hands the Latin hexameter became what Tennyson described as "the stateliest measure ever moulded by the lips of Man," and the unforgettable pictures he wrought—of the last agony of Troy, of the wanderings of the "pious Aeneas," of the tragic

passion of the ill-starred Dido—have moved to sympathy generation after generation as nothing else in all literature has done

In the field of light and satiric verse, the genial and accomplished Horace (Quintus Horatius Flaccus, 65–8 B C) triumphed as surpassingly as did Virgil with the epic He embodied his philosophy of "idealized common sense" in phrases of such unforgettable charm that many of them have become as familiar as proverbs "The school book of the European world, the 'Odes' have been for no less than 19 centuries the companions of mature years and the delight of youth" In his mildly ironical "Satires" and "Epistles" he left the most complete and vivid picture we have of life in the Augustan age

There was nothing of Horatian self-restraint and even-souled calm in the brief erratic life of Sextus Propertius (c 49–16 B C), who flashed on the Roman world as a boy of 20 with a volume of passionate poems celebrating his love for the capricious "Cynthia" A gentler and more refined young poet of the same time was Tibullus (59–18 B C), in whom grace and melodiousness took the place of Propertius's fire

These two poets both used the metrical form called the "elegiac," which their brilliant contemporary Ovid (43 B C–A D 18) polished

WRITING A LETTER IN LATIN

This wall-painting from Pompeii shows a Roman girl thinking over her theme before she begins to write In her left hand she holds her wooden tablets, and in her right her "stylus," or pen, with which she will scratch her words in the wax that coats the surface of the tablets

National Museum Naples photo Anderson

POET OF LOVE AND LEGEND

Ovid is most familiar to us as the author of the delightful 'Metamorphoses which tells in beautiful verse many of the old tales of Roman legend He was also the great love poet of his age and perfected what is called the "elegiac" metre

Uffizi Gallery Florence photo Brogi

to the same perfection to which Virgil brought the hexameter and Horace various lyrical forms

A facile and copious writer, Ovid became the uncrowned laureate of the later Augustan age, whose glittering coldness and cynical worldliness he so perfectly embodied in his "Art of Love" For us the most attractive of his many productions is the romantic "Metamorphoses"—a fascinating narrative poem as long as the Odyssey—in which he has interwoven a vast number of stories from the ancient mythology

The Augustan age was pre-eminently the Golden Age of Latin poetry, but to this time belongs also the most famous of the Roman historians Livy (Titus Livius), 59 B C–A D 17, is noted for the splendour of his rhetoric He preferred literary effectiveness to historical accuracy, so that his narrative of Rome from its founding is more like a prose epic, a series of splendid pictures, than a critical history

After Ovid and Livy the decline of Roman literature set in rapidly, but in the so-called Silver Age that followed there are still several writers who invite and deserve attention

The satirist Juvenal (A D 60–140) and the epigrammatist Martial (A D c 40–c 104) belong to this later period Juvenal's savage castigations of Roman life have been translated and imitated by many English poets, especially Dryden These men are chiefly interesting to us today for the picture they give of Roman life in the days of the Empire The tragedies of Seneca—Nero's tutor—with their ghosts and their dismal lack of acting qualities, were the

chief models for tragedy, as Plautus and Terence were for comedy, among the early writers of English drama. Today we read them as curiosities, though we can still enjoy Seneca's philosophical studies written in letter form.

Tacitus (55–120), whose terse, pungent, and vivid style has sometimes been compared with that of Carlyle, gives us a number of valuable historical pictures. The "Germania" is our only view of Central Europe under the early Roman Empire. His "Agricola" is a very beautiful piece of biography and describes Agricola's campaigns in Britain. And what remains of his "Annals" and "Histories" is our chief source for the events of the first century of the Roman Empire. He mentions briefly the first Christians in Rome, but was obviously unable to foresee the importance which they were to assume. The historian Suetonius (75–160), a writer of much less distinction than Tacitus, had the advantage of being one of Hadrian's private secretaries, and could therefore write his very gossipy "Lives of the Twelve Caesars" from the documentary sources.

Perhaps the most interesting writings in Silver Latin are the letters of Pliny the Younger (61–c. 113). The most famous is the one telling of the death of his uncle Pliny the Elder in the eruption of Vesuvius that buried Pompeii. As a whole these letters give a racy picture of the time that is also pictured in Juvenal and Tacitus. Pliny the Elder (23–79) was the author of a "Natural History," which is a priceless storehouse of information about the science of ancient times. Two other works of the Silver Age strike a more modern note, the literary criticism of Quintilian and the "Satyricon," the prose novel of Petronius Arbiter.

With the gradual breakdown of the Roman Empire which followed the death of Marcus Aurelius (A.D. 180), literature almost disappeared. Although there were brief flickers of activity from time to time, the genuine Roman spirit was dead. Latin continued to be written for fifteen hundred years, throughout the Middle Ages and beyond it; but though many important books, like St. Augustine's "Confessions," and much poetry—many of our oldest hymns, for example—were written in Latin, Latin literature after the second century never reached the heights that it had attained in the Augustan and Silver Ages.

As Latin has never ceased to be spoken as a learned language, its pronunciation has been corrupted by the pronunciation of the various languages of Europe. Thus the name *Cicero* is pronounced in Italy *Chichero*, in England *Sisero*. But in the teaching of Latin in many English schools the consonants *c* and *g* are always given their hard sound, and the "continental" vowel sounds taught. Thus *Cicero* is pronounced kik'ār-ō, *Augustus*, ow-goos-toos, and *Horatius*, hōr-ah'-ti-oos.

LINES ACROSS THE GLOBE
To make it easy to find places on the map, geographers draw imaginary lines across the globe—lines of latitude (parallel to the equator) and longitude (through the poles).

Latitude and Longitude. (Pron. lat'-i-tūd, lon'-ji-tūd.) To indicate accurately the position of a place on the surface of the earth, geographers imagine the globe to be covered with a network of lines regularly spaced. Those running east and west—parallel to the Equator—are called "parallels," and the distance between them is measured in "degrees of latitude." Those running north and south—from pole to pole—are called "meridians," and the distance between them is measured in "degrees of longitude." Instead of marking each degree, which would make a confusing network of lines on the map, every fifth or tenth degree only is usually marked.

In numbering the parallels, we begin with the Equator as zero and count north and south. Thus the first degree north of the Equator is one degree north latitude, usually written "lat. 1° N.", and the first degree south of the Equator is one degree south latitude, or "lat. 1° S." Since the distance from the Equator to either of the poles is one-fourth of a circle round the earth, it will measure one-fourth of 360 degrees (the number of equal parts into which a circle is divided), which equals 90 degrees. Thus 90 degrees north latitude marks the position of the North Pole, 90 degrees south latitude that of the South Pole.

In numbering the meridians most countries by agreement have chosen as the point of departure the meridian passing through Greenwich, where the British Royal Observatory was established in 1675. Beginning with this as 0°, the first degree east of Greenwich is called one degree east longitude, or "long. 1° E.", the first degree west is "long. 1° W.", and so on until 180 degrees (half of 360) have been measured off eastward and westward. The 180th meridian is on the other side of the earth, exactly opposite to the one which passes through Greenwich, and, with it, it forms one of the great circles which pass through the poles round the earth. This meridian is neither "east" nor "west," for both the east

Topical

'ZERO HOUR' OF LONGITUDE

Most countries now calculate longitude from the meridian of Greenwich In the grounds of Greenwich Observatory stands this tablet which shows longitude 0° Greenwich time is set from the moment at which the sun passes over this imaginary line

and west reckonings end here Other meridians which have at times been used in calculating longitude are the ones passing through Washington (U S A), Ferro (Canary Is), and Paris

As you can readily see, the circles forming the parallels decrease in size from the Equator to the poles The meridians all meet at the poles, therefore the North Pole cannot be said to have longitude It has only latitude (lat 90° N), and from there the only direction is south, just as from the South Pole the only possible direction is north A degree of longitude measured on the Equator is a little more than 69 miles This distance decreases until at 30° it is a little less than 60 miles, at 60° about 34½ miles, and at the poles zero

A degree of latitude measured from the Equator to the first parallel north or south is about 68¾ miles, but between lat 45° and lat 46° it is a little more than 69 miles If the earth were a perfect sphere the degrees of latitude would, of course, all be an equal distance apart, but the earth is flattened at the poles and bulging at the Equator, which accounts for the difference which we have just noted

The determination of both latitude and longitude depends upon astronomical observations Latitude is found at sea by measuring with an instrument called a sextant the sun's angular distance above the horizon when it is at the highest point or "zenith"—that is, at exact noon From astronomical tables which give the "declination" of the sun (its distance north or south of the Equator for that day) the latitude is then found

One of the easiest ways of computing longitude at sea is by noting the difference in time between that given by the observation of the sun at noon, and that given by a chronometer, or watch set to Greenwich time The longitude is the amount by which noon by Greenwich time is earlier or later than noon at the observer's point, one hour's difference in time means 15° difference in longitude

Other imaginary lines on the earth's surface are the two tropics—the Tropic of Cancer (23½ degrees north of the Equator) and the Tropic of Capricorn (23½ degrees south of the Equator) These two parallels mark off the belt round the middle of the earth in which the sun, at some period of every year, is directly overhead

The polar circles are the same distance from the poles that the tropics are from the Equator The Arctic Circle, therefore, is 66½ degrees north latitude, and the Antarctic Circle is 66½ degrees south latitude They mark off the regions around the poles where each year there is at least one day when the sun does not set, but is visible above the horizon for the full 24 hours

Latvia. Latvia or Letvia—the "land of the Letts"—is a name that has appeared on our maps since 1918, the country comprises most of the former Russian provinces of Courland and Livonia, and lies between Estonia and

Fox Photos

CROSSING THE EQUATOR

When a British ship crosses the Equator, members of the crew, dressed up to represent envoys of Father Neptune, ask the captain's permission for him to come aboard and hold an investiture For those who have not crossed the Equator before, the ceremony ends in a ducking in an improvised tank This photograph shows the ceremony in progress on board H M S Sussex.

Lithuania on the Baltic Sea The Gulf of Riga makes a deep indentation on the north-west coast Latvia possesses about 340 miles of sea-coast, and there are good harbours at Riga, Liepaja (Libau), and Ventspils (Windau)

Much of the surface of the country is very low, and there are many marshes and peat-bogs, but part of Livonia consists of wooded hills, picturesque deep valleys, and charming lakes Latvia is mainly an agricultural country, but the people are passing from agriculture to industrial

> *Area* —25,000 square miles (including inland lakes) Population, 1,950,000
> *Physical Features* —A flat region, largely forest Chief river, the Dvina (Daugava)
> *Principal Products* —Rye, barley, oats, wheat, flax, timber, butter and other foodstuffs
> *Chief Cities* —Riga (capital), 385,000, Liepaja (Libau), 57,000, Daugavpils (Dvinsk), 45,000

life Rye, oats, barley, flax, potatoes, and some wheat are raised The principal exports are flax and timber Riga, the capital, with a population of 385,000, is the chief seaport, and an important centre of trade and manufacture

The Letts, who make up about 76 per cent of the population, are, with the Lithuanians, a separate branch of the great Indo-European family, akin to the Slavs

In the 13th century what is now Latvia was a part of the territory conquered and Christianized by the Crusading Teutonic knights It was added to Russia by Peter the Great, and remained a part of that country until it was established as a separate republic in 1918

MAKING MERRY IN LATVIA

St John's Day, June 24, is a happy holiday for the people of Latvia The country people decorate not only their houses but also themselves, whether old or young, with garlands of foliage, generally oak leaves

Photo Press Section Latvian Foreign Office Riga

Latvia was admitted to the League of Nations in 1921 There is an elected Parliament of 100 members called the *Saeima* The Lettish language is akin to the Lithuanian, and there is quite a considerable literature, rich in poetry and proverbs

LAUD BLESSING STRAFFORD

While Laud was lying in the Tower under sentence of death, the Earl of Strafford, who was also condemned to death, sent a message to the Archbishop begging him to be at his window and give him his blessing as he passed to the block This painting shows Strafford receiving the blessing outs de Laud's cell

From the painting by P Delaroche

Laud, WILLIAM (1573–1645) The son of a Reading clothier, educated first at the free school of his native town, this remarkable man rose to the highest position in the Church in the reign of King Charles I He first attained royal favour under James I, and was an even greater favourite with Charles I, who made him Archbishop of Canterbury in 1633 Laud, while in power, made every effort to enforce strict discipline in the Church and exact ritual in religious practice This made him very unpopular, and eventually his unconstitutional methods proved his downfall The Long Parliament had him thrown into the Tower, and he was condemned to death and beheaded

Laundry AND DRY-CLEANING Washing clothes, always a highly unpopular Monday morning task in the home, is now a big, thriving industry The laundryman takes your washing to an efficient power laundry

equipped to make short work of what is a back-breaking job for the housewife

With careful system, the soiled pieces are identified by indelible marks or tags, then sorted and dropped inside the cylinder of a huge washer The cylinder, of wood or stainless steel, can rinse and toss as much as 600 lb of clothes at one time It rotates inside a water-filled shell, whirling the clothes through thick suds and dropping them into the bath hundreds of times without ever scouring them over a rubbing board There are 10 to 12 washings in suds, rinsing water and blueing water

Then the clothes go into a water-extractor in the shape of a whirling metal basket which spins the water out "Rough wash" is dried by means of hot air and sent home "Finished service" is starched when necessary, and sent to the ironers All "flat work," such as towels, table cloths, and sheets, passes between a polished, steam-heated surface and a series of soft padded rolls Clothing is finished on steam-heated presses and touched up with electric hand irons It requires the most careful work to remove spots and stains, and to bleach the clothes without damaging them

Silks, velvets, woollen suits and dresses, felt hats, and fine rugs must all go to the dry-cleaner French cleaners formerly removed grease or dirt with solvents, *e g* benzine or petrol These are replaced now chiefly by petroleum naphtha Today garments are agitated in a metal washer with a clear solvent, then with a soapy solvent Next they are rinsed in a flow of cleaning fluid and whirled dry Then stains of fruit coffee, grease or ink are removed by expert spotters and finally the article is pressed

Laurel. You know the laurel, probably, as the tree whose leaves woven into a wreath, adorned the victor at the ancient games of the Greeks and Romans, and still, in fact, make the victor's wreath at many modern events But this tree, in Britain, we usually call the bay, although its scientific name, *Laurus nobilis* shows clearly enough what it really is It is not often a large tree, although at times it may exceed thirty feet in height, sending up a mass of long, straight shoots rather than a single stem It is seen more often in garden shrubberies and churchyards than anywhere else, but it is not really a native of this country You also come upon it in the most urban of situations, perhaps as a neat, rounded bush on a long straight stem, standing in a green-painted tub on a hotel's steps The wood, though hard, of good colour and fine grain, is seldom large enough to be of value

W B Johnson

TRUE AND COMMON LAURELS

The true laurel which is better known as the bay, has medium-sized, pointed leaves whose margins are wavy This plant (top) also has berries, borne in ones or twos from the axils of the leaves But in the common laurel (lower), the leaves are very large and shiny, with a regular margin, while the flowers, and the berries which follow, are in racemes

The sweet laurel, as the bay is occasionally called, is found growing native in the Mediterranean districts of Europe and in Great Britain It belongs to the family which includes the camphor and other trees remarkable for their aromatic qualities From the berries and other parts of the sweet laurel is distilled an aromatic oil used in the manufacture of toilet waters The dried leaves also are used for flavouring in cookery and in pickling pilchards

The ancient Greeks were accustomed to use entwined twigs of this tree to crown victors of the Pythian games The tree was sacred to Apollo, and the nymph Daphne, when pursued by Apollo, was, in answer to her prayers, changed into a laurel The placing of a laurel crown on the brow of poets dates from the Middle Ages

The trees which we know as laurels in Britain are no relation of the bay, but are really members of the same genus as the cherries and the plums, *Prunus*, and of these the commonest is actually known as the cherry laurel (*P laurocerasus*) This tree which has been grown in England for several hundred years, comes from the Caucasus It has large, leathery leaves, shiny on the upper surface and rather like those of the rhododendron, and, like that shrub, it is popular as undergrowth and in the shrubbery It can, however, reach quite a good

size, although it is seldom grown as a real tree The flowers of this species are white, and the fruits black The leaves, when cut up and bruised, smell very strongly of bitter almonds (prussic acid or hydrogen cyanide), and are actually powerful enough to be used in insect-killing bottles When distilled, they yield the oil of hydrocyanic acid, which is a most deadly poison, in spite of this, it is sometimes used, but in a very diluted form, for flavouring icing, etc

The Portugal laurel (*P lusitanica*), which is also of long-standing introduction, has the leaves spotted with yellow and is not so commonly planted Finally, there is the spurge laurel (*Daphne laureola*), a very small shrub with long, narrow, dark green leaves, and tiny green flowers which open very early in the year This shrub is a relative of the popular garden mezereon

Laurier, Sir Wilfrid (1841–1919) This "Grand Old Man" of Canadian Liberalism, the Right Hon Sir Wilfrid Laurier, Prime Minister of Canada from 1896 to 1911, was born November 20 1841, of humble French-Canadian parents In 1864 he entered the practice of law in Montreal, and in 1874 was elected a member of the Canadian House of Commons

In 1877 he became Minister of Inland Revenue and Administration In 1887 he was chosen, though a French-Canadian and a Roman Catholic, to become leader of the Liberal party Under his guidance the fortunes of the Liberals soon revived, and in 1896 he was called upon to form a government Thus he entered on that 15-year tenure of the Premiership which was to make him one of the great figures of Canadian history He was the first French-Canadian to hold this important office

In his attitude toward Great Britain Laurier may, perhaps, best be described as a Liberal Imperialist When the South African War broke out, not long after his advent to power, he dispatched several contingents of Canadian volunteers to South Africa to fight there the battles of the empire Then, and always, he was thoroughly loyal to the British Crown But he was also loyal to Canada He regarded the British Empire as an alliance of free and equal nations, and he opposed every attempt, from whatever quarter, to limit Canadian freedom It is a significant fact that it was during his period of office that the last British soldier was withdrawn from Canadian soil, and that the schemes for a Canadian navy took form

So far as his domestic policy was concerned, Laurier was guided by a splendid faith in Canada's future His immigration policy brought into the country hundreds of thousands of settlers, and his railway programme looked toward the spanning of the country with not one transcontinental track, but three lines of railway "Build up Canada" became the watchword of his government In the general election of 1911 he was defeated, and Mr (later Sir) Robert Borden, the leader of the Conservatives, succeeded him as Premier

SIR WILFRID LAURIER

Laurier was one of the greatest of Canadian statesmen Intensely loyal to the British Empire, he conceived, before the time came for its fruition, the idea of a Commonwealth of free and independent nations owing allegiance to the British Crown

When the World War broke out, Laurier gave the government his whole-hearted support When, however, in 1917, the government adopted compulsory military service, he found himself unable to continue his support, and he had the tragic experience of seeing a large element in his own party desert him His policy was defeated in a general election, and on February 17, 1919, he died, still at variance with many of his former followers

Lava. You have all heard of the terrible things which happen when a volcano erupts (*see* Volcano), and of all these perhaps the worst is the flow of lava This is the more or less completely melted rock discharged from the volcano Molten lava is a very thick fluid saturated with gases and steam Its fluidity depends on its temperature, the amount of vapour it contains, and its chemical composition Those lavas which contain not more than 58 per cent of silica are called basic lavas, and melt at about 2,250° Fahrenheit Lavas containing 66 per cent or more of silica are acid lavas and remain more or less pasty even at 3,100°

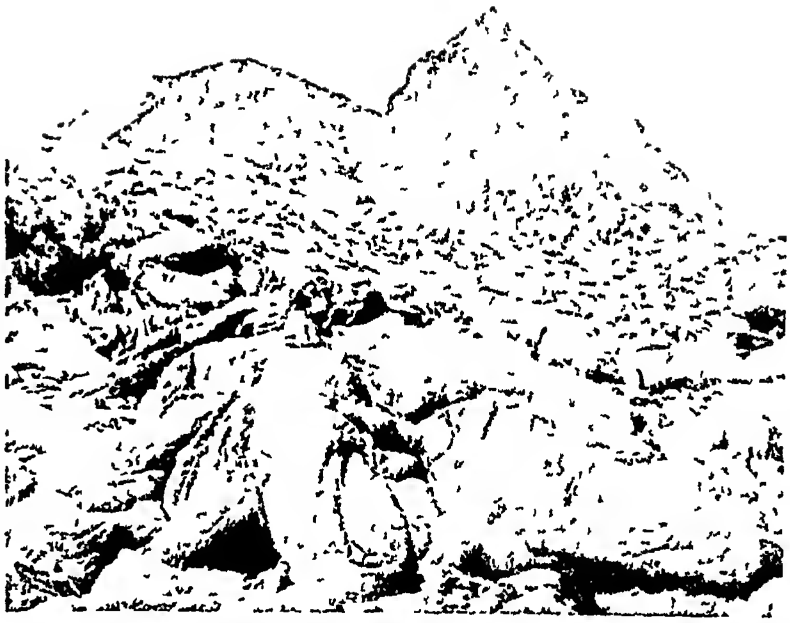
The rate of flow of basic lava is faster than that of acid lava, and the cones of the volcanoes producing it are generally low and have gentle slopes Mountains which give forth acid lava tend to have high steep cones Lavas usually flow slowly, rarely as much as a mile an hour

If lava cools so quickly that there is no opportunity for the constituents to crystallize, it is glassy and forms *obsidian* Lava which has large crystals embedded in a ground mass of small crystals is called *porphyry* The top of lava is often frothy from bubbles of

gas and is then called scoriaceous *Pumice* is rock froth so light that it will float on water (*See* Pumice) There are, of course, many other rocks composed of lavas, which indeed have done a tremendous amount to make the face of the earth what it is today (*See also* Geology)

Lavender. Even if you have no garden you will know the lovely fragrance of this plant, perhaps the favourite of all old-fashioned scents, and used for all sorts of perfumery In the linen cupboard the chest of drawers and the wardrobe the dried flowers of this delightfully fragrant shrub are still largely used by housewives

Lavandula vera is a bush about 18 inches high, and the familiar spikes of bloom rise above the leaves another 18 inches The flowers and their stalks should be picked when the sun is on them if the full fragrance is to be retained after they are dried Lavender is a native of southern Europe, and grows best on chalky soils, in sunny positions At one time the great English lavender beds were at Mitcham, just south of London, but a deadly disease made it no longer worth while growing the herb there Other closely-related species are grown sometimes in gardens The sea-lavender (statice) belongs to a different family



LAVA ROCKS ON THE SIDE OF VESUVIUS

One can see that these twisted rocks now hard and firm, were once part of a stream of molten matter that flowed out of the crater of the volcano Vesuvius, for they have the appearance of a fluid suddenly solidified How terrifying that wave of hot molten rock must have been when it poured like a slow-moving flood down the mountain-side !

Lavoisier, ANTOINE LAURENT (Pron lav-waz'-yā) (1743–1794) "The Republic has no need of scientists," declared the president of the tribunal that sent Lavoisier, "father of modern chemistry," to the guillotine in May 1794, when the French revolutionary terror was at its height This fanatical declaration drew forth from Lagrange, the great French mathematician, the retort "You have in a moment cut off a head whose like may not be seen again for a century"

Lavoisier was born in Paris, August 26, 1743, and first came into prominence in 1766, when his essay on the best method of lighting Paris was awarded the first prize Thereafter, he occupied himself with physics, chemistry, meteorology, agriculture, economics, currency questions, armament manufacture, and hygiene, in all of which he excelled by the breadth of vision and intuition he brought to bear in order to clear away age-old and deep rooted fallacies

The outstanding feature of Lavoisier's brilliantly versatile career is that he discovered nothing ! His virtues were, so to speak, individually negative, yet the sum of their effects was to establish physics and chemistry on sound rational bases He founded the modern theory of the chemical elements, and inaugurated the modern science of quantitative organic analysis He destroyed the *phlogiston* theory, which pre-supposed that an inflammatory, unknown principle resided in combustible bodies, and so paved the way for a true science of heat He gave the name oxygen ("acid producer") to that gas, and showed with Laplace, that water is formed by the combustion of oxygen and hydrogen

Science will always honour this martyred genius, for, in the words of Liebig, the great chemist, "his merit, his immortal glory is that he infused into the body of science a new spirit"

Lavoisier's greatest work was his "Traite elementaire de Chimie," 1789 "Memoires de Chimie," published by his widow in 1805, was completed just before he was guillotined Between 1862 and 1893 the complete works of Lavoisier in six volumes were published by the French Ministry of Public Instruction The great chemist's portrait is reproduced in p 947

Law, ANDREW BONAR (1858–1923) Although Bonar Law was Prime Minister for only seven months—from November 1922 to May 1923—there have been instances of even shorter terms, and his importance as a statesman was spread over a number of years

The son of a Presbyterian minister, Bonar Law was born in New Brunswick, Canada,

September 16, 1858, and was educated first in Canada, and then at Glasgow He started his business career in that city, and rose to be one of its leading citizens, being prominently associated with the iron trade until he first entered Parliament as one of the members for Glasgow, at the age of forty-two He became leader of the Conservative Party in the House of Commons in 1911, and served in both Coalition Governments in the World War

An unassuming man, with no claims to being an orator, and disdaining to use any of the tricks of rhetoric and noisy pretensions by which smaller men have sometimes contrived to make themselves prominent, he was, nevertheless, during the whole of his Parliamentary career distinguished as a most skilful debater and an able and level-headed politician Possessing a marvellous memory, Bonar Law spoke without notes Even when presenting the Budget, with its great array of diverse figures and facts, he relied on his memory to an extent unequalled by other Chancellors of the Exchequer At the same time he never spoke without being sure of his facts, and if challenged across the floor of the House he could quote his authority as readily as make a retort

ANDREW BONAR LAW
Bonar Law, a statesman of great ability, will be remembered for his unselfish devotion to what he believed to be the best interests of the State, and by his notable lack of personal ambition
Elliott & Fry

The character of the man was revealed by the way in which he tendered the fullest support of the Opposition to Asquith's Government in the early days of the War, and by the lofty patriotism with which he rallied his party to the support of the national cause when he might have exploited some of the difficulties the nation found itself in as a means for securing party advantage Bonar Law died October 30, 1923, and was buried in Westminster Abbey

RULES *that* GOVERN *the* HUMAN FAMILY

Though laws exist primarily to stop us doing certain things, they are not irksome, for without them no one would be safe. Like a good father, they are just but not unkind

Law and Lawyers We use the word law with at least three fundamentally different meanings In its widest sense, law expresses the relation between cause and effect Students of the sciences found, after long observation, that natural objects and forces can be depended upon to act in certain ways, these ways are natural laws Thus the chemist speaks of the law of the conservation of matter, the physicist, of the laws of motion, the biologist, of the laws of heredity

The Law Courts in London

In a narrower sense the word law refers to the social life of Man Thus we speak of laws of etiquette, laws of honour, and the moral law Historians tell us that when people first began to live in groups they had no rules or laws, but they soon realized that each man had to pay attention to the needs and welfare of his neighbours in order to make life not only pleasant but possible for the greatest number These rules or customs were at first unwritten, and were not always observed When law in this second sense failed, when ridicule or ostracism were not effective checks, the state stepped in, making law in a third sense

The word law is now most commonly used in this stricter or more positive sense of rules or codes which the state enforces through its political organization The earliest code of laws that has come down to us is that of Hammurabi, the Babylonian monarch, who lived about 2100 B C Sometimes laws proved unsatisfactory and were changed, as for example when the harsh laws of Draco, in the 7th century B C, were displaced by the more humane code of Solon

The Romans, with their genius for government, gradually built up a remarkable body of law based on long-established custom, modified and increased by judicial decisions and legislative enactments, which the Emperor Justinian codified in what came to be called the Roman

Civil Law So logical and just were its principles that it has been called "crystallized reason" In the latter part of the Middle Ages the study of this Roman law was revived in the universities of Europe It has determined the general character of the laws of every nation in western Europe except England

Before the Norman invasion of England, each manor, borough, or shire had its rules based on established custom—laws of tradition After the Normans conquered the island, judges appointed by the king moved from place to place to administer these local laws, and gradually popular custom gave way to judicial custom In medieval England a custom was held to be law if it had been in force (in the old phrase) "from a time when the memory of Man runneth not to the contrary" As time went on, the decisions of the judges, constantly modified by later decisions, were accepted as the body of English "common law"

Statute law, or legislation, is another kind of law which grew up because conditions arose to which judge-made or common law did not apply This is law made by legislative bodies, such as parliaments, congresses, and legislatures Furthermore, two chief types of law came to be recognized civil law, which sets forth the rights of persons, with methods for maintaining or regaining them, and criminal law, which deals with the nature of actions harmful to the public and the private good, with punishments for offenders Constitutional law is the basic law of a nation or state, and it sets forth in general terms the nature of the government established under it

Canon law arose in the Middle Ages to deal with Church matters. It was administered in separate Church courts, with the Pope at the head, and there were numerous conflicts of jurisdiction between the Church and the secular courts The new code of the canon law is a collection of all the disciplinary laws of the Roman Catholic Church

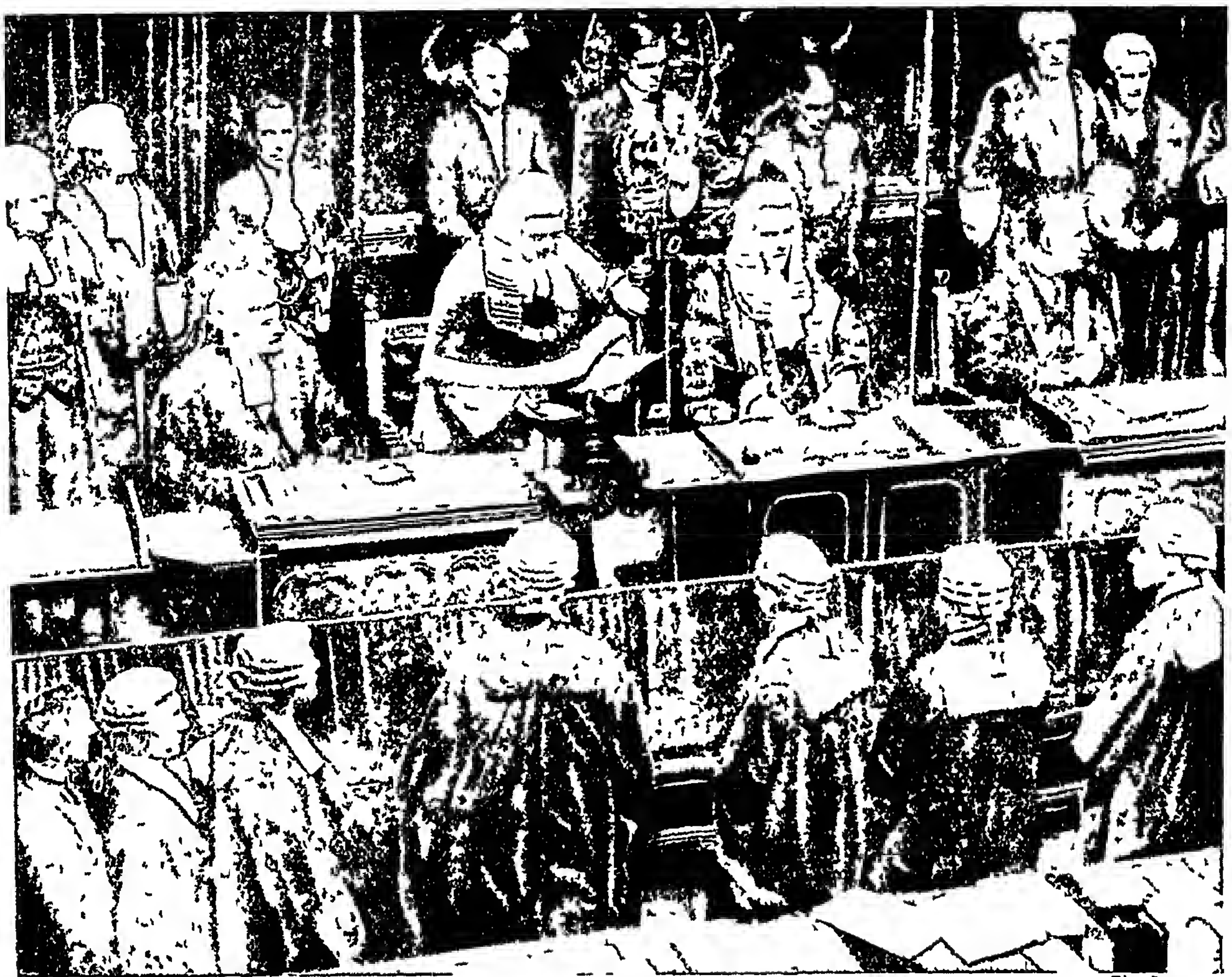
"Equity" is the name that is applied to a body of legal principles which arose in England to remedy the injustices which were done by a strict application of the letter of the law For a long time (until 1873) the English Courts of Justice were distinct from the "equity" tribunals, which were under the Lord Chancellor Military law is the set of rules used for governing a military organization Martial law is the suspension of civil laws in time of emergency, such as invasion or insurrection, and the enforcement of military law on the civilian population Parliamentary law is not "law" It is merely a body of rules to regulate the procedure of a deliberative group

The legal profession is crowded, but many persons with legal training enter business in which they find their knowledge of great value In recent years women have entered the legal profession Law has become so complex that it is almost impossible for one to become an expert in all its branches Laws are constantly changing and are so voluminous that only a specialist can keep himself fully informed

Barristers and solicitors, who plead in the courts as advocate or counsel,

LAWYERS IN PROCESSION

At the opening of the Michaelmas term at the Law Courts, judges and barristers attend a service at Westminster Abbey or Westminster Cathedral, and, before going on to the Law Courts, are entertained by the Lord Chancellor at the House of Lords The top photograph shows King's Counsel, in full State dress, entering the Law Courts, and the lower, Junior Counsel entering the House of Lords Notice the difference in their wigs



The Times

SWEARING-IN THE 'LORD CHIEF' AT THE LAW COURTS

This photograph shows the scene in Court when a new Lord Chief Justice is being sworn in, i e, takes the oath of allegiance to the King The Lord Chancellor is in the centre of the photograph with the Lord Chief Justice on his left Behind the Lord Chancellor are on his right, the mace-bearer and purse-bearer and, on his left, Judges of the High Court and King's Counsel The photograph shows Lord Chief Justice Hewart being sworn in by the Lord Chancellor, the late Earl Birkenhead in 1922

or otherwise act as a client's legal agent, form the two great branches of the profession

To qualify for call to the English Bar takes at least three years, and the candidate must become a student of one of the four Inns of Court in London—the Inner Temple, Middle Temple, Lincoln's Inn, and Gray's Inn A large proportion of law students who now enter the Inns have taken a University degree An interesting feature is that a certain number of dinners must be attended in the hall of an Inn to "keep terms" The higher grades in the profession—king's counsel (K C) or judge—are open only to those who have established a good practice Further details may be obtained from the Council of Legal Education, 15, Old Square, Lincoln's Inn, W C

Training to be a Solicitor

To become a solicitor (once called an "attorney"), the usual method is for a youth to be articled to a member of the profession for five years, or he may serve in a solicitor's office as an ordinary clerk for ten years There are three examinations (controlled by the Incorporated Law Society, Chancery Lane, W C), but the preliminary is often excused Passing the intermediate and final examinations, and the payment of certain fees, admit the candidate to practice (*See also* Courts of Justice)

Law, International "The law of nations," or international law, is the group of rules and principles which by general agreement the states of the civilized world observe in their relations with one another Rome had a code of laws, called the *jus gentium*, governing its relations with foreigners, in which we find some of the early beginnings of international law as it is understood and practised in modern times

With the growth and intercourse of the modern states at the close of the Middle Ages, the need of an accepted body of principles governing their relations began to be felt, and a number of writers, foremost of whom was Hugo Grotius, a Dutch scholar, published treatises on the subject In Grotius's book, "De jure belli et pacis" (published in 1625), we have the basis of much of the subsequent work on the subject, including the following principles

(1) war should be carried on only for a just cause, and for the purpose of defence, (2) do no more injury to the vanquished than is strictly necessary, (3) force alone ought not to regulate the relations of peoples, for there is justice between states as well as between individuals, (4) to observe treaties is the wisest practice and the greatest strength of sovereigns

In a strict sense international law is not *law* It is only a body of customs and conventions which the nations have agreed to accept, and its force depends on the good faith of the states that accept it Treaties ordinances of states, decisions of international tribunals, and the opinions of prominent jurists are studied to determine what rules have been most generally accepted In recent years international congresses have been held to determine and interpret various phases of international law, the most important of these being The Hague Peace Conferences (*q v*) held in 1899 and 1907 One of the most satisfactory features of the post-War settlement in 1919 was the establishment at The Hague of the Permanent Court of International Justice (*See* Arbitration)

International law recognizes that a sovereign state has complete authority within its own borders and, in the case of maritime states, a jurisdiction over the sea for a distance of about three miles from its coast The freedom of the high seas, or that part of the ocean which lies beyond territorial waters, is possessed by all

In reducing the sufferings of war, international law made considerable progress in the 19th century, but the practices of the World War of 1914–1918 violated many cherished principles In the wars in China, Japan, and Spain in the nineteen-thirties principles which, it had been fondly believed, were well established were shown to rest on the flimsiest foundations More and more it came to be felt that, despite the efforts of many generations of international jurists, the law that, in the last resort, governs the relationship of nations is that of the jungle

EVERYBODY'S SUMMER GAME

Wherever one goes in summer one passes tennis courts where the great summer game is in full swing And in London, Wimbledon is a greater attraction than Lord's during the Championship matches

Lawn Tennis. Lawn tennis is a modern development of the much older game of real tennis, which is now but little played The present game was first played in England about 1874, and it has increased rapidly in popularity having gradually, through various changes in the rules, reached its present highly developed form It is one of the few sports in which women, now freed from tiresome dress restrictions, can play with men, though a good tournament-class man player could probably defeat the world's greatest woman player

A Wimbledon "Star"

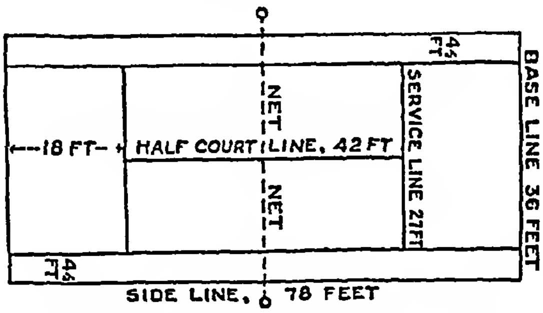
The tennis court is marked out on a closely cut level grass lawn, or on a hard surface like gravel asphalt, or concrete, it is 78 feet long and 27 feet wide A hard court is, of course usable throughout the winter season When four persons play the game the court is 9 feet wider, the extra width being taken up by two side strips, each 4½ feet wide It is divided in halves by a net 3 feet high in the centre, and 3 feet 6 inches at the posts which support the ends White lines or tapes indicate the base lines, side lines, service lines, and half-court line within the court

The object of the game is for the player on one side of the net to send the ball into his opponent's court in such a manner that it cannot be returned The ball is a hollow sphere of rubber covered with white felt not more than 2½ inches in diameter The racket is a flat net of tightly-strung gut in a frame, with a handle a little more than a foot long, the whole is about 27 inches in length and usually weighs from 12 to 14 ounces, though there is no restriction in the rules on the size or weight

At the start of a match of singles—as the game is called when two persons play—one player "serves" while the other "receives" The server stands with both feet behind the base-line, throws the ball into the air, and by striking it with the racket sends it over the net into his opponent's service court diagonally opposite If the first ball is a "fault" he tries with a second ball The receiver, or "striker-out," as he is called must hit the ball on the first bound attempting to send it back over the net so that it will fall within the court If he fails to return it over the net or sends it outside the court he loses the point After the service has been returned either player may hit the ball before it has bounced, *i e* "volley" it

The ball frequently passes to and fro across the net several times before one of the players

fails to return it. The service alternates, first from the right, then from the left court, and a player continues to serve until he wins or loses a game, when the service passes to his opponent. The doubles game on the larger court—with two players on each side of the net—is played in the same manner, except that the partners alternate in serving, and different tactics must obviously be employed.



HOW A TENNIS COURT IS MARKED

This shows the standard plan and dimensions of a tennis court for both "singles" and "doubles" play

The first point won makes the score 15, the second point 30, the third 40, and the fourth wins the game unless each side has scored 40. In that case the score is "deuce," and in order to win the game thereafter one side or the other must take two points in succession. The scores "15 to 0" and "30 to 0" are called as "15 love," "30 love," etc., the opposite being "love 15," and so on. The first of the two points after "deuce" is called "advantage in" (also "van' in," "vantage server," or "vantage So-and-so") if won by the server, and "advantage out," etc., if won by the striker-out.

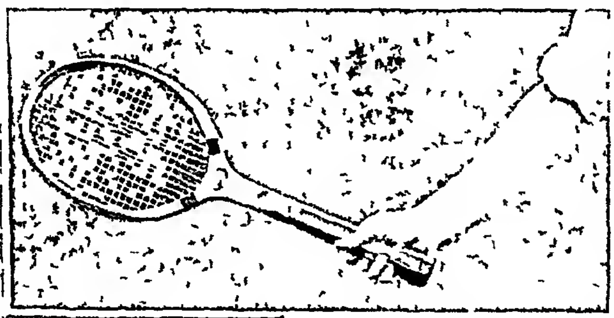
At the end of each game the player who has served becomes striker-out while his opponent serves. The play continues until one player wins six games, which gives him the "set." If, however, the score should become five games all, one player or the other must win two consecutive games in order to win the set. Sides are usually changed at the end of every odd game. A match is the best of three or five sets.

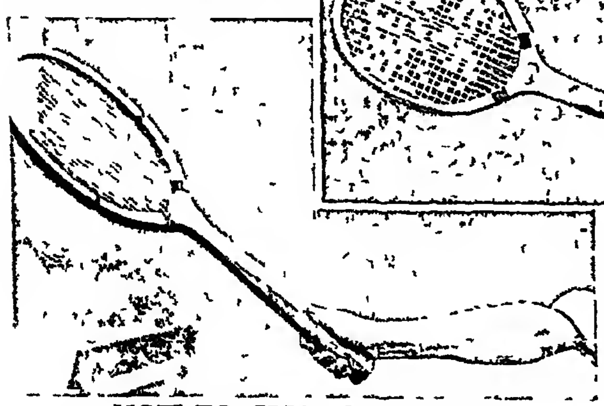
The principal strokes used in returning the ball are the "forehand drive," the "backhand," the "volley," the "half-volley," the "lob," the "drop-shot," and the "smash." If the player is right-handed, and the ball falls to the right of his (or her) body, he stands sideways to the ball, with his left foot forward, and uses the forehand drive by hitting the ball with a smooth forward swing near the top of its bounce. If the ball falls to his left, he advances his right foot, swings the racket across his body, and hits the ball with a backhand stroke.

Often when he can reach the ball before it bounces, he "volleys" by hitting it while it is still in the air. If his opponent has run in close to the net he sometimes "lobs" by sending the ball high over the opponent's head. The overhead "smash" is employed in "killing" any weak return that his opponent may send high above the net, and the "drop-shot" is used to send the ball softly just over the net—a stroke needing great accuracy of touch.

Service gives opportunity for many skilful strokes. There are two styles of service in lawn tennis—the overarm and the underarm—although the latter is rarely used by modern exponents of the game, as sufficient speed cannot be given to the ball without sending it "out" or "away." With the overarm service, the full striking force of the arm can be used, and the style can be varied. To an inexperienced player "spin" or "swerve" services are difficult to take, but the first-class player relies as much on speed as on finesse.

To the annual Championships of the All-England Lawn Tennis (and Croquet) Club there come to Wimbledon—the "Mecca" of world tennis—players from nearly every nation. Many of the men play for their country in the International Lawn Tennis Championship for the Davis Cup. The nearest approach to this gruelling competition in women's tennis is the Wightman Cup, played for annually by teams representing Great Britain and the U S A. (*See also* in Fact-Index.)

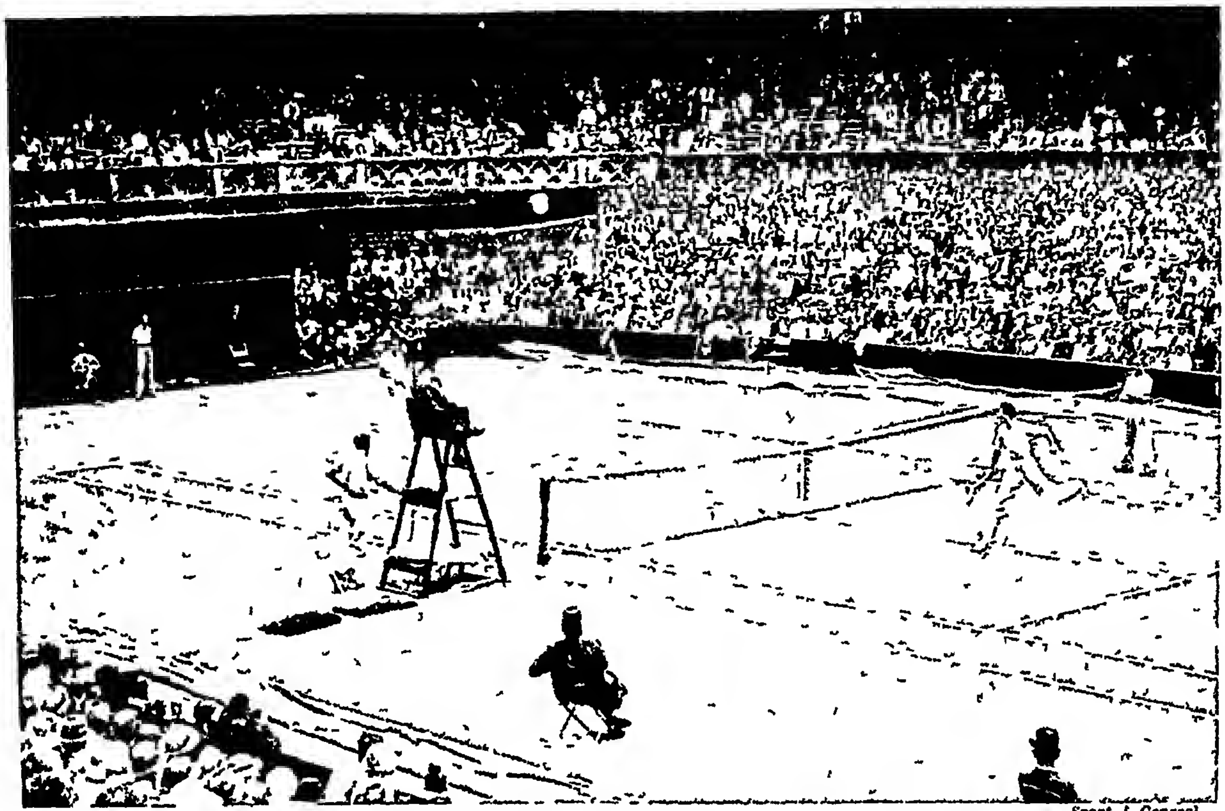




HOW TO GRIP THE RACKET

Above are the handgrips adopted by the majority of lawn tennis players for (top) the forehand drive, and (below) the backhand. Note that the racket is held at the very end of the handle to give a smooth swing

The Lawn Tennis Association, the governing body of the game in Britain, organizes two other important events—the Hard Courts Championships, now held at Bournemouth, and the Covered Courts Championships at Queen's Club. During the season there is a long succession of tournaments, in which both "open" and "handicap" events attract a large entry of aspiring players of both sexes. There are also special events for "juniors."



Sport & General

WIMBLEDON CENTRE COURT ARENA OF THE CHAMPIONS

Even to play in the Championships at Wimbledon is the hall-mark of a first-class lawn-tennis player To win is the greatest honour that he or she can achieve, and every summer the finals are fought out on the Centre Court, in an atmosphere tense with excitement Here, during the men's singles final of the 1937 Championships the eventual winner, J D Budge (right), of the United States, has come up to the net to volley a shot made by his German opponent, Baron von Cramm For an important match like this, there are linesmen and ball-boys on duty in addition to an umpire

There is much discussion as to the relative merits of the greatest men players in the history of lawn tennis Some veterans of the game say that no modern player, despite the all-round speeding-up and higher standard of play, would have been able to beat the brothers R F and H L Doherty, who reigned at Wimbledon in the 'nineties and in the early part of the present century The Renshaw twins were earlier champions, W Renshaw winning the men's singles on seven occasions—six of them consecutive After the Dohertys and A W Gore came the invasion from abroad, such players as N E Brookes (Australia) and A F Wilding (New Zealand) being worthy champions of the game The year 1919 saw the introduction of the "cannon-ball" service, used with deadly effect by G L Patterson (Australia) The greatest of all American players, W T Tilden, won the first of his three victories in 1920 Later there came the reign of France's "Four Musketeers,"—J Borotra, R Lacoste, H Cochet and J Brugnon—the first three of whom became singles champions F J Perry was the next "home" player to "win at Wimbledon"—he did it three times running, in 1934, 1935, and 1936—and J D Budge (U S A) won in 1937 and 1938

In women's tennis, the late Mlle Suzanne Lenglen, of France, first won the Wimbledon crown in 1919, at the age of 20, and proceeded to win again in 1920, 1921, 1922, 1923, and 1925 Other great players include Mrs G W Hillyard, six times champion, Mrs Lambert Chambers, seven times champion, and Mrs Helen Wills Moody, compatriot of Tilden, who equalled this record Miss Ryan, another American, won 19 doubles championships

The professional side of the game subsequently claimed many of the "stars" including Cochet, Tilden, Perry, and H E Vines Professional players, of course, are not allowed to compete in championships and tournaments with amateurs

Lawrence, THOMAS EDWARD (1888-1935) A motor-cycle accident on an English country road brought to a dramatic close one of the most remarkable and romantic careers of the twentieth century "Lawrence of Arabia" had become famous the world over because of his amazing exploits as leader of the Arab revolt against the Turks (1916-18), and his dislike of publicity, which led him afterwards to change his name twice and hide himself in the ranks of the Royal Air Force, had made him an almost legendary figure

Lawrence was born August 15, 1888, in North Wales After a regular school course he

went to Jesus College, Oxford, where his unusual personality began to show itself His attendances at classes were irregular, he spent his nights roaming about the city, he read continuously, skimming over thousands of books on a variety of subjects

At an early age Lawrence became interested in the Middle Ages, and this interest resulted in a journey to the Near East, to study the castles of the Crusaders He tramped all over Palestine, Syria, and Mesopotamia, becoming acquainted with the Arabs, and thus laid the foundations of his great life-work

'Daily Mirror

'LAWRENCE OF ARABIA'

T E Lawrence, who is often spoken of as "Lawrence of Arabia," is here seen wearing the costume of the country that he loved so well He had a great dislike of any form of publicity, and photographs of him are rare

When the World War broke out Lawrence was recalled to England to carry out mapping work, but he was soon transferred to the intelligence service in Egypt Soon afterwards he was sent to Arabia, with the rank of colonel, and there he began to take an active part in the revolt of the Arabs against their Turkish oppressors

Lawrence arrived at a time when the Arabian forces were scattered, weakened, and discouraged With tireless energy he rode all over Arabia, winning the confidence and admiration of the tribes, constantly urging Arab unity He identified himself completely with the Arabs and their cause, he rode about on the swiftest camels, wearing beautiful white flowing robes and the headdress of an Arab chieftain, he often went for days at a stretch with little sleep, he endured even greater hardships than the Arabs themselves Soon Lawrence had organized the latter into a fighting unit, and by a series of lightning manoeuvres he time and again outwitted the Turks, routing them from strong positions and inflicting heavy losses

The Arabs will long remember Lawrence—they called him "El-Aurens"—for his train-wrecking The Turks controlled a railway which ran to Medina, where they had a strong army entrenched Over this railway food and supplies were regularly sent Lawrence planted mines—"tulips" he called them—blew up supply trains, and captured the provisions for his Arabs

As the campaign continued, Lawrence working closely with General Allenby and the Arabian Prince Feisal, moved steadily north He won battle after battle, until in one last magnificent push his forces completely destroyed the Fourth Turkish Army and captured Damascus

Lawrence's major task was over But Arab independence was still close to his heart, and he looked after Arab interests at the Peace Conference The Middle Eastern Settlement of 1921, in which he took a prominent part, he considered a much more important accomplishment than his victory over the Turks This work ended, he retired from public life, to write his account of the revolt, "The Seven Pillars of Wisdom" An abridged edition was later issued, the famous "Revolt in the Desert" All the money that came to him from the sale of the "Revolt" he gave to set up an education fund for officers' children Throughout his life he would take nothing by way of reward, neither money nor military decorations, for his part in the Arabian struggle Later he received an appointment at Oxford, but was soon called to the Colonial Office to advise on Arab affairs Again he retired, entered the Royal Air Force as a mechanic, transferred to the Tank Corps, and finally returned to the Air Force To escape unwelcome attention, he changed his name by deed-poll, first to Ross, then to Shaw His most important work during this period was a new translation of Homer's Odyssey

Leaving the Air Force, for a few months he had led the secluded life of a scholar when his fatal accident occurred

Lead. The great weight and softness of lead and the ease with which it is extracted from its native ores have made it one of the "handiest" metals since very ancient times, and its great resistance to most acids has given it a high place in modern chemical trades and industries

Pure lead is used chiefly today for making water-pipes, coverings for electric cables, chemical tanks, and storage batteries Mixed with a small amount of arsenic, it is made into small shot and shrapnel bullets, with 25 per cent of tin it gives solder The principal lead compounds employed in the arts and manufactures are white lead (a form of lead carbonate), used for making paints, red lead, or "minium" (one of the lead oxides), also used for making paint, particularly for ironwork to prevent rust formation, and litharge (lead monoxide), used in making flint glass and for glazing pottery. The so-called "lead" in pencils is not lead at all, but a form of carbon called graphite (*q v*)

Before the invention of high-power explosives had compelled the use of tougher metals, all rifle bullets were cast of lead The small shot of olden days was made in high shot towers, from the top of which molten lead passing through a sieve fell in tiny drops, which cooled on their downward journey and plunged into water tanks at the bottom, the impact restoring the globular shape temporarily lost while falling

Lead in its pure state is greyish-white in colour A fresh-cut surface will glitter brilliantly, but quickly becomes dull on exposure to the air Because it lacks rigidity and tensile strength it is unfit to support any great strain, either pull or pressure It melts at 327 4° Centigrade (621° Fahrenheit)

Lead is mined chiefly in the form of galena (lead sulphide), which is usually found associated with silver The process of extraction is simple, the ore being roasted until all the sulphur is burned away

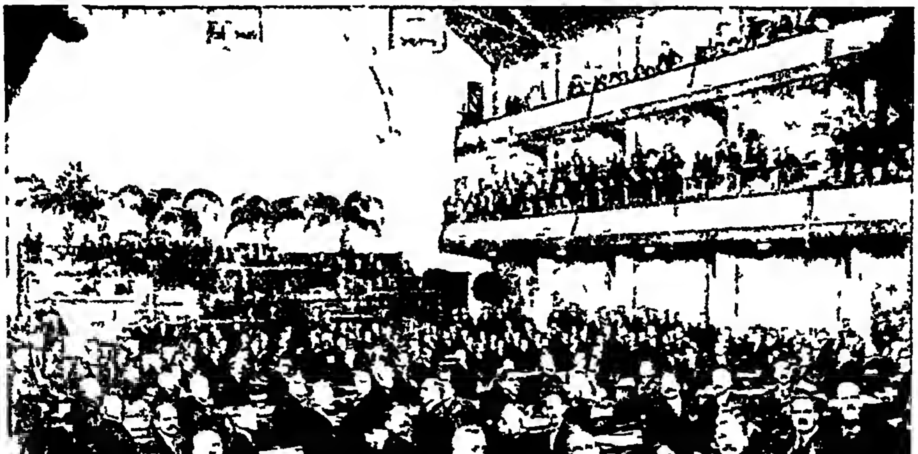
All the compounds of lead are poisonous Special caution is required in occupations where quantities of this metal are used, such as glazing, painting plumbing, and printing for lead is a cumulative poison, that is succeeding amounts accumulate in the body, gradually producing graver symptoms extending from colic to nerve paralysis, blindness, convulsions, and death There is practically no danger from lead plumbing where the water is hard for a coating of insoluble salts is formed on the inside of the pipes, but with soft water poisonous soluble compounds are formed and must be guarded against

Lead was known to the Romans, who used it extensively for water-pipes, tanks, weights, and rings It is often mentioned in the Bible

League of Nations. Long before the League of Nations was established, efforts had been made to solve international problems by round-table discussions They all tended to confirm the opinion that representatives of nations can harmonize national with common interests and settle disputes without war

Innumerable international meetings had been held—in a single year as many as 160—to consider special aspects of world problems, and since the organization of the International Postal Union in 1874 an increasing number of permanent official international bureaux were set up with administrative and other powers The Hague Tribunal, established in 1899, was a long step toward an international organization, providing, as it did, a nucleus for a world court of justice

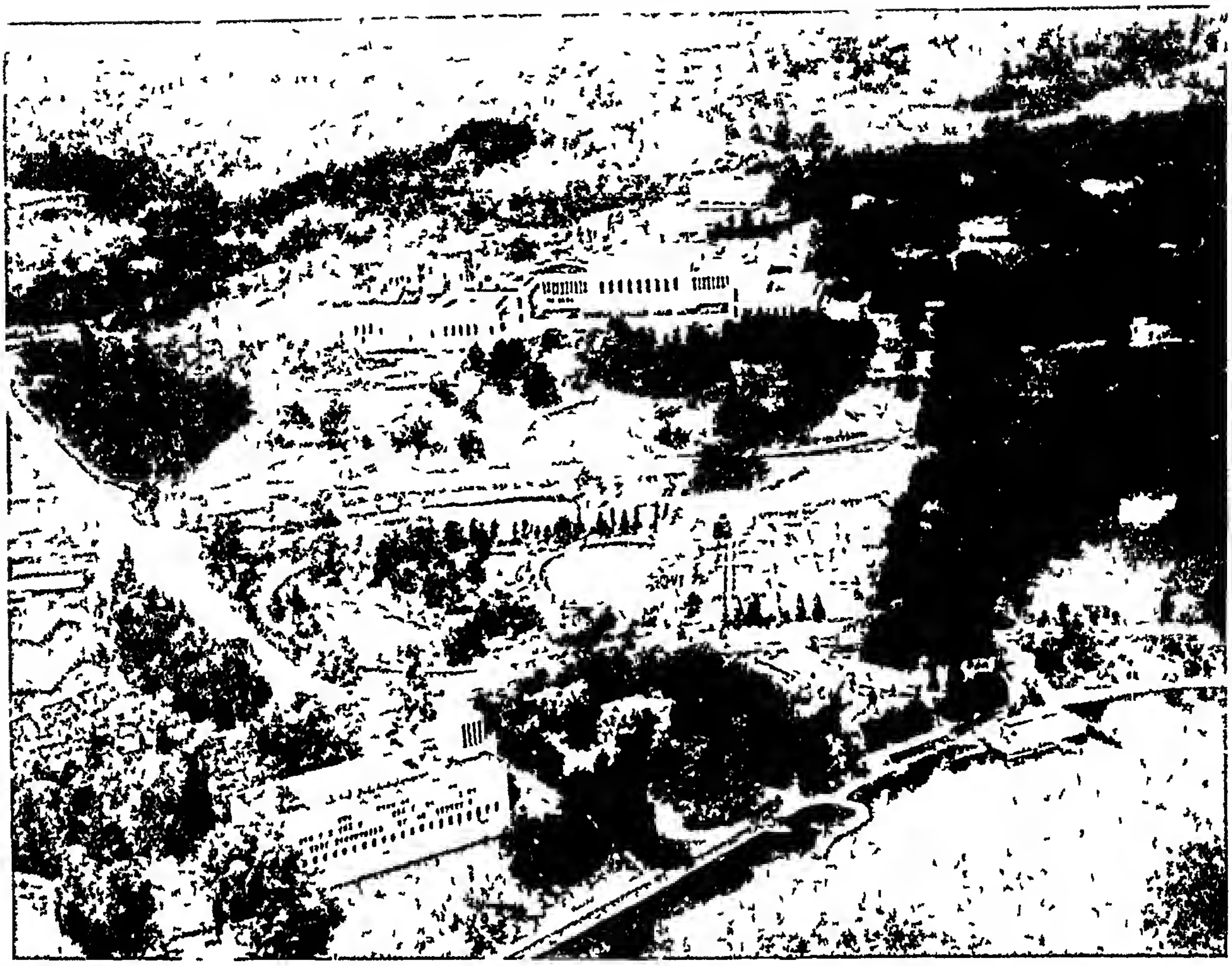
To President Woodrow Wilson of the United States belongs the chief credit for forming a League of Nations In his famous "Fourteen Points" (January 8, 1918) he named this as part of the peace programme, subsequently accepted by the Allies and by Germany in the Armistice negotiations "A general association of nations," read Point Fourteen, "must be formed under specific covenants, for the purpose of affording guarantees of political independence and territorial integrity to great and small states



FIRST ASSEMBLY OF THE LEAGUE OF NATIONS

The first meeting of the League of Nations Assembly, shown in this photograph, was held in the Salle de la Reformation at Geneva opening on November 15 1920 It lasted for 37 days, and was attended by delegates from 42 states Matters dealt with were the framing of rules for procedure the establishment of the Permanent Court of International Justice, and disarmament

Courtesy of the League of Nations photo F H Jullien



PALACE OF THE LEAGUE OF NATIONS AT GENEVA

The great palace in which the League of Nations is housed at Geneva replaced a disused hotel in which the affairs of the League had been previously conducted The building, which covers an area of 4½ acres, was begun in March 1931, and first occupied in February, 1936 It cost £2,000,000 The secretariat occupies one huge wing, in which is the Council Hall accommodating about 2,000 people A fine library occupies a part of the other wing In the centre of the block are the Assembly buildings, which house the delegates Round the buildings are pleasant park-like grounds, as can be seen here

Courtesy of the League of Nations

alike " His insistence at the Peace Conference made the League a part of the Versailles Treaty Many offered suggestions as to plan, the one most closely followed in the Covenant being that of General Jan C Smuts of South Africa

The efficiency of the League of Nations was, however, greatly impaired by the absence of the U S A as a signatory, the American nation refusing a mandate that would allow America's intervention in non-American controversies

The machinery of the League today consists of an Assembly, a Council, and an international Secretariat The Assembly, which meets usually once a year, is composed of three representatives from each of the member countries, and each state has only one vote The Council meets at least three times a year Great Britain, France, and Russia are permanent members, and eleven non-permanent members are at present annually chosen by the Assembly Germany and Japan withdrew in 1935, Italy in 1937, and Peru, Hungary, Albania, and Spain in 1939

The Council selects the permanent Secretary General for the League who, with his staff forms the Secretariat New member states are admitted upon the consent of two-thirds of the Assembly They must be self-governing countries, including dominions and colonies Withdrawal from the League requires two years' notice and fulfilment of all obligations With few exceptions all votes in both Council and Assembly are required to be unanimous Geneva is the seat of the League

The purposes of the League are to prevent wars by insisting upon arbitration and judicial decision to settle disputes, secure a reduction of national armaments, and prevent international traffic in arms, drugs, women, and children, and to obtain fair and humane conditions for labour, etc All treaties entered into by member states must be registered with the Secretariat of the League

A system of " mandatories " responsible to the League is set up to rule the former German colonies and certain portions of the old Turkish Empire, and other territories Finally, in Article 10, the members undertake " to respect and preserve as against external aggression the

territorial integrity and existing political independence of all members of the League" The chief weapon to be used against offending states is an economic blockade This part of the League machinery broke down completely in 1936, when it was found impossible or inexpedient to employ all the "sanctions" clauses against Italy during her campaign against Abyssinia, a fellow League member that Italy had herself proposed for membership The League had previously failed in the Chinese-Japanese dispute of 1934, when Japan wrested Manchukuo from China

The first meeting of the Executive Council was held in Paris, January 16, 1920 On November 15, 1920, the full Assembly of the League met in Geneva for the first time, with 41 countries represented Fifty-eight states were members in 1938 Great Britain's share of the cost of upkeep is the highest

Court of International Justice

An important adjunct to the League is the Permanent Court of International Justice, or World Court, of eleven judges and four deputy judges to hear cases voluntarily submitted by disputing states, concerning interpretations of treaties, questions of international law, breaches of international obligation, and reparations for such breaches The judges are elected for terms of nine years by separate majority votes of the Council and the Assembly from a list of nominees Sittings are held in The Hague Peace Palace

The International Labour Office is closely connected with the League, and also has its headquarters in Geneva The governing body is composed of 12 Government representatives, eight employers' representatives, and eight workers' representatives

The League of Nations Union, with headquarters in London, is an organization for supporters of the League Viscount Cecil is its President

Lear, Edward (1812–1888) If you haven't yet made the acquaintance of the works of Edward Lear, a great treat is in store for you For he was the writer and illustrator of two of the most famous humorous children's books in the world "The Book of Nonsense," which consists of Limericks, and "The Nonsense Book" These are books of pure nonsense We call Lewis Carroll's "Alice" books nonsense, too, but they are deliberately witty and well thought out, often almost scientific, they have not the spontaneous "craziness" of Lear

Born in London, May 12, 1812, Lear was patronized by the Earl of Derby, for whom he drew series of sketches of the menagerie at Knowsley, and for whose children the nonsense rhymes were first written Later Lear lived in Rome, travelling widely in the Mediterranean region, and he died at San Remo, January 30, 1888 By profession in fact, he was a serious water-colour painter, and his 'Illustrated Journals of a Landscape Painter" enjoyed as much popularity for their illustrations as for their text But his fame rests principally on the books mentioned above, popular alike with children and with adults

In his preface to "The Book of Nonsense," Edward Lear gives a summary of his life together with some verses about himself

How pleasant to know Mr Lear!
Who has written such volumes of stuff!

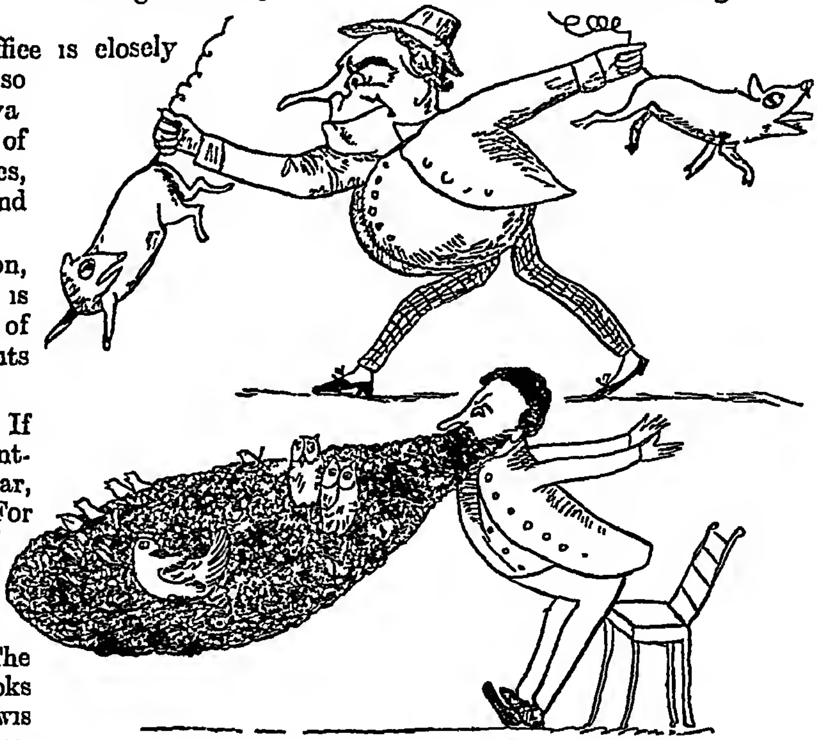
he begins, and he goes on to tell us that

His mind is concrete and fastidious,
His nose is remarkably big,
His visage is more or less hideous,
His beard it resembles a wig

And here, to finish up with, is one of his Limericks

There was an Old Person of Anerley,
Whose conduct was strange and unmannerly,
He rushed down the Strand,
With a pig in each hand,
But returned in the evening to Anerley

Limericks we hear nowadays usually contain a fresh rhyme in the last line The origin of the term Limerick is doubtful, some suggestions are given in the article under that heading



LEAR'S DRAWINGS FOR HIS LIMERICKS
Here are two of Edward Lear's own illustrations to his "Book of Nonsense" The upper illustrates the Limerick about the Old Person of Anerley (see text in this page), while the verse for the lower drawing is "There was an old man with a beard, Who said it is just as I feared! Two Owls and a Hen, four Larks and a Wren, Have all built their nests in my beard!"

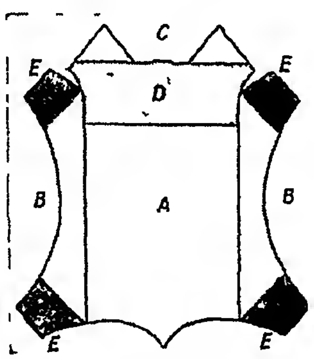
How HIDES & SKINS *become* LEATHER

"There's nothing like leather" is an old saying and a true one, for, despite Man's ingenuity, he has found no satisfactory substitute. This article tells leather's story from bullock's back to boot or bag

Leather. Have you ever wondered where leather comes from—that tough, soft, pliant, yet wonderfully hard-wearing stuff which now has so many uses? It makes your shoes, and sometimes even your clothes; it takes things about for you in bags and trunks of every size and shape; it keeps things together as straps; it covers upholstery and makes harness; and there is, as many people will tell you, still no good substitute for good leather.

Leather is actually the hides of animals, chiefly domestic animals such as the cow and horse. The skins of the larger animals are called hides. The hides of smaller animals, such as sheep, goats, pigs, dogs, etc., are known to the trade as "skins." The deer, kangaroo, buffalo, antelope, and water animals such as the alligator, walrus, and seal (not the fur-bearing seal, but a quite distinct species), also furnish leather. In recent times all sorts of lizards, snakes and crocodiles and even sharks, have been made to yield their coverings as "leather" for fancy articles, such as handbags, and for ladies' shoes. Among birds, the ostrich also yields a good leather.

Before the hides are ready for use as leather, they have to go through a good many processes. These processes are much the same today as they were among the ancient Egyptians, for modern ingenuity has not been able to hasten and improve the manufacture of leather to the extent it has done for most other manufactures. The first step is to remove the skin from the animal, whole and without blemish. With modern tools this is done very skilfully and quickly; sometimes air is forced under the skin with a bellows to make removal easy. If the hides go at once into the tanning process they are left untreated or "green." If there is any delay they must be dried, or "green salted," that is, have salt rubbed into the fleshy side to prevent decomposition.



PARTS OF A HIDE

The parts of a hide are known as (A) the butt, (B) belly, (C) cheek, (D) neck, and (E) shanks

At the tannery the skins and hides are trimmed to remove flesh and useless parts, and put into "soaks"—large tanks of brine. Here they are left for from two to four days to be plumped, softened, and cleansed. The "fleshing" machine next removes all fat and tissue remnants. The hair is loosened by a chemical bath, and is scraped off by another machine.

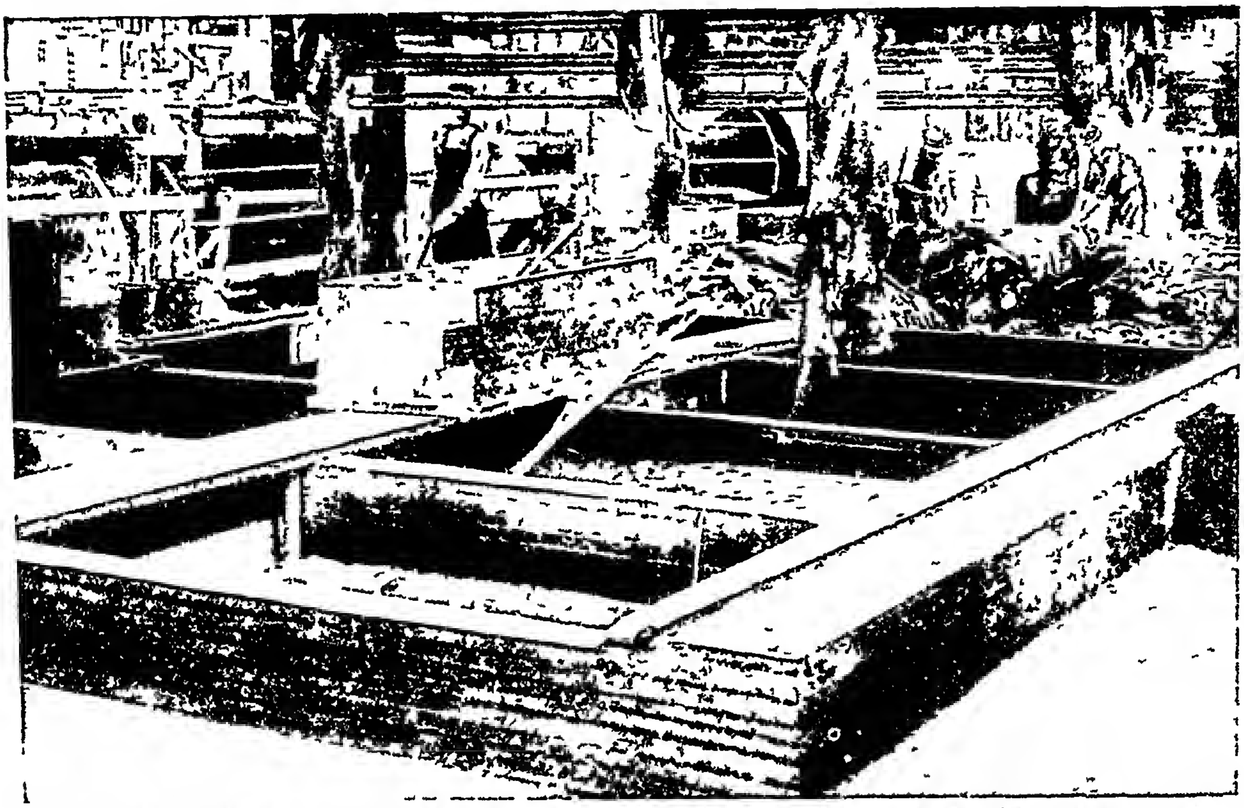
After thorough washing and trimming the hides are ready for tanning. The purpose of tanning is to stop decomposition, to give the hides greater strength, toughness, and pliability, and to make them proof against water. There is a choice of processes, upon which will depend the grade and special quality of the finished leather. The chief processes are the tan-bark treatment, treatment with oils or tallow, and the chrome or chemical process. When it is desired to tan skins without removing the fur or hair—for example, for use as furs or rugs—they are "tawed" or dry-tanned by packing in moist salt and powdered alum.

Different Barks Used for Tanning

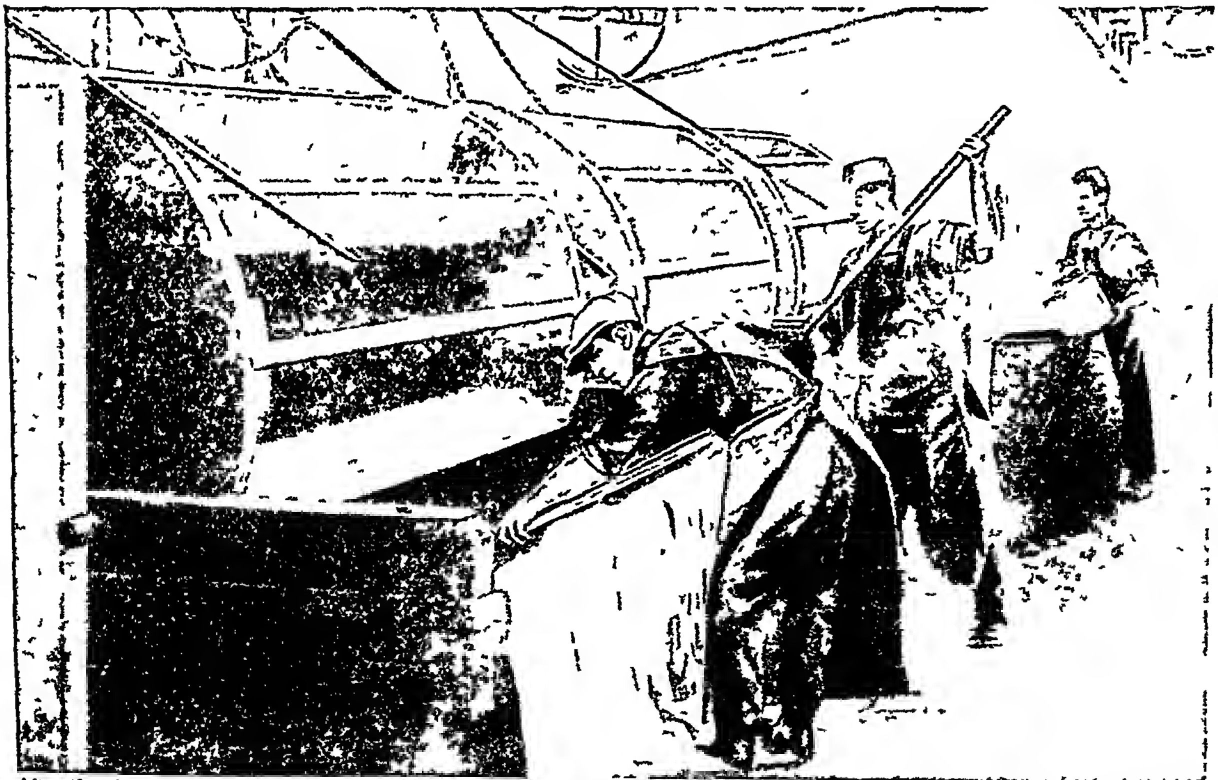
For the heavier leathers and some of the lighter kinds, the tan-bark process is in most general use. Originally the bark of oak-trees was used almost exclusively, and in many parts of Britain large areas were covered with trees grown for this purpose alone. Modern methods however, as described below, no longer require this source of raw material. Barks of many kinds of trees and other vegetable substances containing tannin are now used, and the manner of their use and the choice of barks largely determine the kind and quality of the leather. Most heavy leathers, such as sole and belting leather, upholstery, harness, bag and strap leathers are tanned with hemlock and oak. In Australia the mimosa or wattle-barks are much used. Tannin is also found in the bark and leaves of most forest trees, but the only other ones which furnish enough to be of value are certain willows, chestnuts and birches.

Other tanning materials of importance are *quebracho*, a widely distributed tree of South America; *myrobalans*, the fruit of an Indian tree; *divi-divi*, the dried seed-pods of a South American tree; *galls*, abnormal growths found on oaks, caused by the gall-wasp's laying eggs in the plant; *gambier*, the product of a shrub cultivated in Singapore and the Malay Archipelago; *mangrove*, from the mangrove trees of Borneo; *valonia*, the acorn cup of the Turkish and Greek oak; and *sumach*, the ground leaves of one of the sumach trees (*Rhus coriaria*) grown in Mediterranean regions. Each of these has its especial uses, according to the purpose to which the leather is to be put. But in modern practice vegetable tanning is being

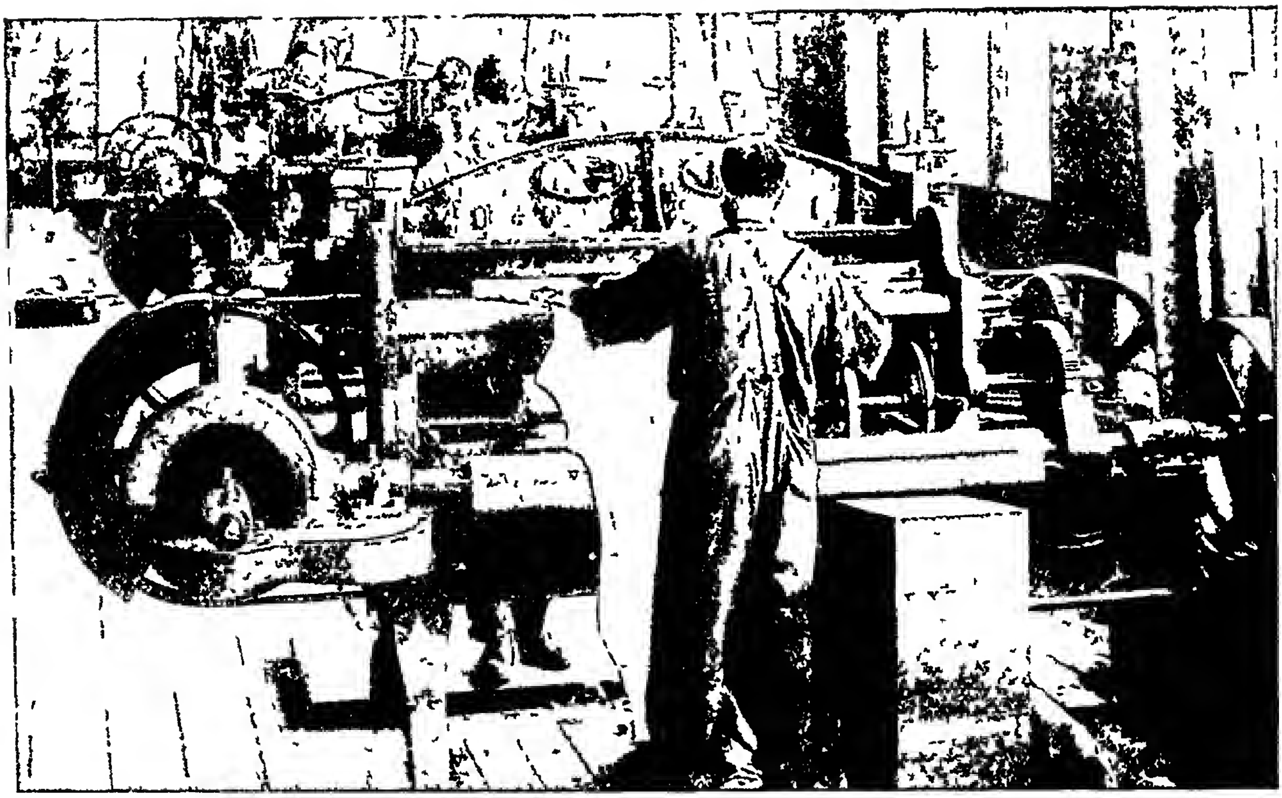
FIRST CHAPTERS IN THE LIFE-STORY OF LEATHER



When the "raw" hides reach the factory, the hanging parts such as the ears and tails are trimmed off, and all clinging bits of flesh are carefully removed. Then the hides are put into lime vats, like the one shown here. The lime loosens the hair. The workmen who handle the hides from the lime vats must wear rubber gloves to keep the liquid from eating into their skin.



After the skins have soaked in lime for a while, they are put into vats like this to be washed clean. The paddle wheels revolve, carrying the hides round with them and, the water being constantly renewed, the lime is gradually removed. If it were left on the hides, it would not only loosen the hair but would affect the skin as well.



LEATHER AT A LATER STAGE THE SPLITTING MACHINE

Here we see a workman putting a hide into the splitting machine This machine is delicately adjusted to shave the hide into two sheets The hair half is called "grain" leather, and the flesh half is called "split" leather The grain leather has the firm tough fibre that made up the outside of the animal's skin, and is therefore of higher grade than the split

used less and less, and so-called synthetic and chemical tannings are more and more popular The actual process of tanning is usually called "tannage"

The skins are suspended in vats containing tanning solutions made of various ingredients, singly or in combination, and are removed from one vat to another, each succeeding vat containing a stronger solution than the one before They are then dried by artificial heat, oiled, and ironed by large rollers

Bark or vegetable tanning requires from 90 to 100 days, while the process of chrome or chemical tanning takes less than a third of that time This process was invented by an American in 1884, and is now the most general mode of dressing light leathers It is also used for heavy leathers where great strength is needed The liquid used is a solution of chromium salts, obtained from chrome iron ore

Oil tanning is used for making soft glove leathers such as chamois, buckskin, and piano leather The process is called "shammying" and consists of working oil into the skins to make them spongy and soft Many of the soft leathers—the "shammy leathers"—formerly treated in this way are now chrome-tanned

The finishing processes are varied according to the use for which the leather is intended The leather, as it dries after tanning, is stiff and rough Rubbing oil into the leather to make it soft and pliable is called "currying" Sometimes the currying and finishing are done as a separate industry, the currier buying the rough leather from the tanner

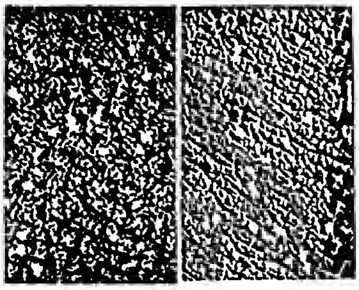
Dull leather, such as is used in the cheaper grades of shoes, may be simply oiled and worked to make it pliable Harness leather and sole leather is put in great presses to make it hard and durable If a lustre is desired a dressing is applied to the grain side of the leather and then it is run through pressure rollers which polish the surface, if a dull polish is desired a revolving brush is passed over the surface Grain leather may also be given a pattern, as is done in box calf or imitation alligator skins

The colouring of leather is an art in itself, requiring great care to bring about a uniform result Different skins going through the same colour bath will be of different shades, and various portions of the same skin may take the colour unevenly, so that the leather may appear spotted

The modern factory aims at doing away with waste The small pieces of leather chipped off in trimming the hides for market are combined with some of the substances used in the course of the tanning, and made into a pulp that will harden into any required shape or into boards to be cut into shoe heels and inner soles The waste fat and tissues cut from the hides are used for glue, while the hair is used for cheap blankets and cloth, or in making plaster

Leathers are distinguished by many names according to their material and treatment The

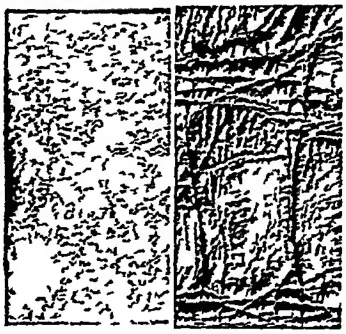
most numerous and useful are made of cow-hide and calf-skin *Box calf* is calf leather stamped with irregular lines forming rough rectangles *Wax calf* is heavy calf-skin with a wax finish *Suede* calf-skin (sometimes kid) is finished by "buffing" or grinding the face on an emery wheel *Dull calf* or *gun metal* has a smooth unglazed finish



About 25 per cent of the leather supply is furnished by the skins of sheep and goats, which are used chiefly for shoe uppers and gloves Kid or goat-skin is the usual material for women's and children's shoes

Glazed or *glace kid* is the most common form, having a smooth highly polished surface *Undressed kid* is a skin dressed only on one side, used chiefly for gloves Heavy plump goat-skin, tanned by a dual vegetable and chemical process and having a semi-bright finish, is called *Dongola*

Morocco was originally a sumach-tanned goat-skin, made in Morocco and stained red, the term is also applied to imitations of morocco, and to any heavily tanned goat-skin Morocco is favoured for book-covers



KINDS OF LEATHER

The four varieties of leather most frequently used are (reading from left to right) morocco and pig-skin (top), calf and crocodile (lower)

Russia leather was originally a very high-grade calf-skin made in Russia and dressed with birch oil giving it a peculiar fragrance, it was dyed a deep red So-called Russia leather is now made throughout Europe and America of heavy skins of various kinds, and finished in tan, brown or black Red Russia is now chiefly used for binding fine books, as the leather is watertight and strong and repels insects *Patent leathers* are made from any firm, soft leather, free from grease and with no tendency to stretch Successive coats of black varnish are applied, until the surface is covered with a heavy coat of enamel, and the last coat is baked on

Cordovan is horse hide, very durable and watertight, the name comes from the Spanish city of Cordova, which had an ancient reputation for making fine shoes Imitations are now made from calf *Chamois* is properly the dressed skin of the Alpine chamois, but the genuine article is very scarce, most of the so-called chamois is

AT THE END OF THE PROCESS—OILING AND DRYING

After the hides have been tanned, they are coloured, seasoned, and oiled Left, we see two workmen applying the oil with soft cloths The right-hand picture shows the men hanging up the hides to dry Once dry, the finished leather is sorted according to weight The heaviest and strongest skins are collected and classed as "first grade," and the others graded accordingly Since leather is sold by the square foot, each hide is measured in a measuring machine and its size marked upon it Then they are put into big bundles for shipping

chrome-tanned sheep-skin *Buckskin*, originally tanned deer-skin, is nowadays usually suède-finished calf-skin or kid It is a buff or cream-coloured leather, almost as soft and pliable as cloth, and is widely used in glove-making

Because of the increasing demand for leather and its consequent rise in price, various substitutes have been devised, some of which closely resemble leather in feeling and appearance, though not in durability They are prepared from strong fabrics treated with collodion-cotton But the shoemaker's boast, "there's nothing like leather," would appear still to hold good so far as footwear is concerned

The GREEN GARMENT *of the* TREES

Usefulness as well as beauty is a function of a tree's leaves, and, indeed, without leaves a tree would surely die, for they extract its nourishment from sunlight and air. How this miracle is performed is described here.

Leaves. Most people look upon leaves merely as the brilliant costume of the trees, without realizing their immense importance to human as well as to plant life By far the largest part of the food you eat is manufactured originally by the leaves of plants—even your breakfast bacon and eggs if you follow them back far enough Indeed, we shall see that leaves are the mouths, the lungs, the stomachs, the pores, and the "eyes" of the plant, without which the plant could not live

Aspen Leaves
Photo A W Dennis

We can learn all the more important facts about leaves by examining any ordinary leaf from a tree or bush From the stem a network of veins branches out to all parts of the leaf Those veins act not only as the fibre skeleton which holds the leaf spread out in shape, but as the "blood-vessels" which connect every portion of the leaf with the deepest rootlet far underground In between the veins the leaf is filled with a spongy mass of green-coloured cells, held in place by a thin skin or membrane on the upper and lower surfaces

Now let us follow the leaf through a day's work as it hangs upon the tree First, we find that the upper surface of a leaf nearly always faces the sunlit sky If a tree is growing close against a high wall, very few leaves will be found on the dark side That is because the leaf needs sunlight to do its work There are a few interesting exceptions to this rule, however, such as the compass plant, whose leaves are turned on edge pointing north and south This is an adaptation to avoid the intense heat of the tropical sun

As the sunlight strikes through the smooth transparent membrane on the upper surface of the leaf small quantities of air enter through thousands of tiny *stomata*—mouths—mostly on the under side At once a strange thing takes place The green colouring matter (*chlorophyll*) of the leaf takes from the air the gas carbon dioxide, and mixes it up with water which has reached the leaf, via the plant's system of "water-pipes" or vessels, from the distant roots Then, with the aid of the sunlight, the leaf manufactures out of this mixture the sugars and starches which are the basis of plant food, and turns out into the air again through those same "mouths" the surplus oxygen The sugars and starches then pass back through the veins and stem of the leaf, and unite with other chemicals in the sap to nourish the plant and build up the hard woody material (cellulose) of the stem and branches

But the leaf performs another important function When they are not drawing in air to make food, the stomata act as pores, and sweat away the excess water sent up from the roots This helps to keep the leaf cool and healthy

In a sense the leaf "sees" the light, for the leaves of a plant growing in a cellar will keep turning toward the windows, no matter how often the position of the plant is changed

Sensitivity to Light and Touch

Scientists have a word for this sensitivity, which they call *phototropism*, or turning towards the light Thus, a plant may be sufficiently sensitive even to react to a passing cloud In some plants, too, the leaves have on their upper surface tiny cells covered with curved transparent membranes like the lenses in a telescope or camera If a film of water covers the upper surface of certain leaves, so as to destroy the focusing effect of these tiny leaf-lenses, they appear to be no longer able to determine the direction of the light It is not certain, however, that these lenses really do anything more than concentrate the rays of light for the benefit of the cells within the leaf The leaves of some plants are sensitive to touch as well as to light, in almost the same way as the tendrils of climbers One of the mimosas, for example, is actually called the "sensitive plant" because its leaves react so strongly to touch

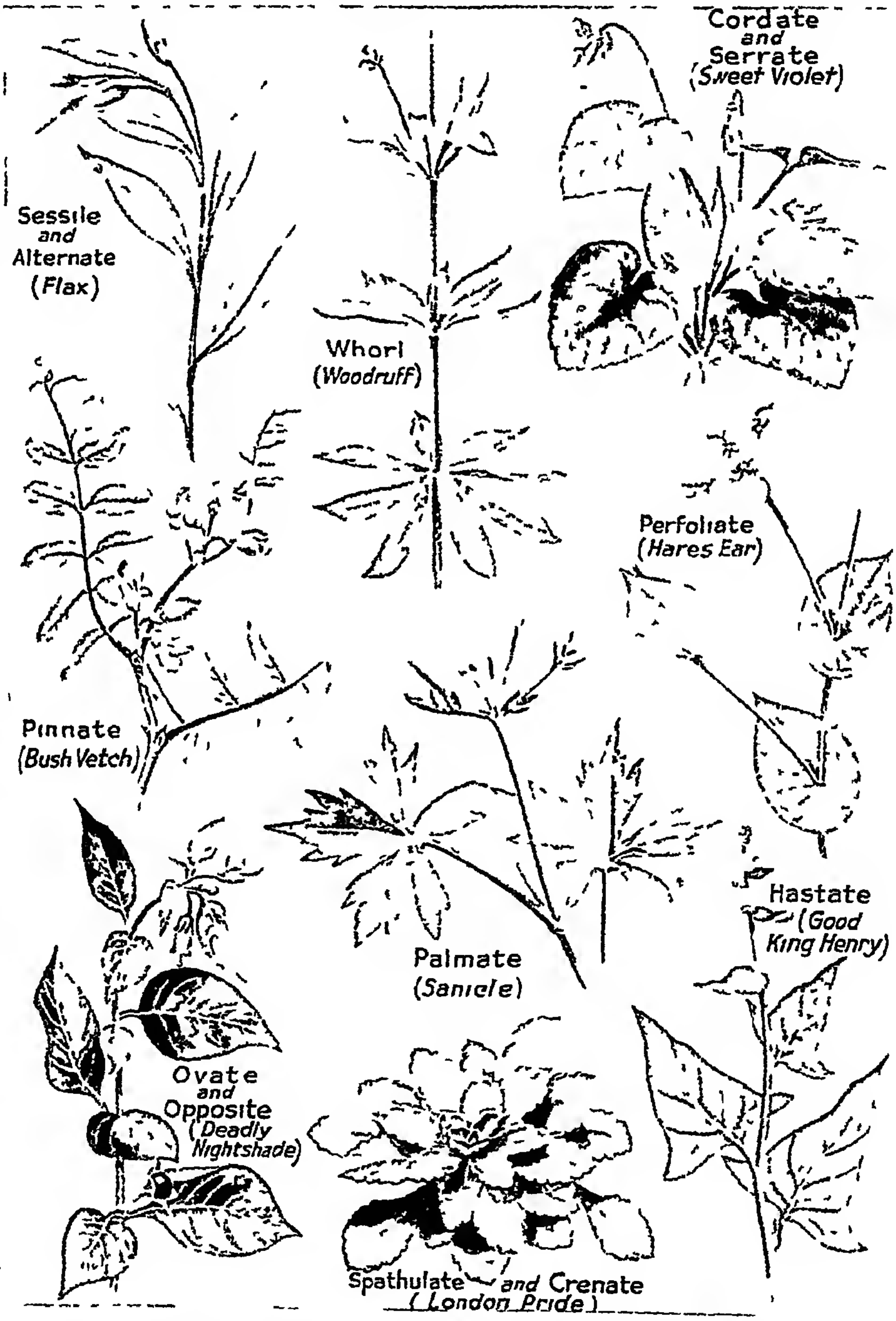
Plants show a wide range of leaf shapes, each suited to particular needs But there are three main types of arrangement of the main ribs of

their skeleton (1) those with several main ribs branching out finger-like from the stem, called "palmate" (from the Latin *palma*, palm of the hand), (2) those with a single large middle rib from which smaller ribs branch out feather-like on each side, called "pinnate" (from the Latin *pinna*, feather), and (3) those in which the ribs do not form a branching network at all, but run from stem to tip, called "parallel-veined"

It must be borne in mind that these terms refer only to the venation (veining), not to the shape of leaf, where the terms palmate and pinnate have a much more restricted meaning For instance, the round nasturtium leaf, the slightly indented leaf of the scarlet geranium, the ivy leaf with its sharp lobes, and the leaf of the horse-chestnut, which is split into sections clear down to the stem—all have the palmate system of venation Yet you would find, in a book about flowers, that the leaves of the first are referred to as round, those of the second as lobed, and those of the third alone as palmate—and even for the horse-chestnut this word is not always used Similarly, the beech leaf, the oak leaf, the elm leaf, and even the locust leaf, which consists of groups of pairs of small leaflets arranged around the main stalk, are all good examples of the pinnate type of venation Yet the beech leaf is ovate, the oak leaf lobed, the elm leaf often obovate and the locust leaf alone is truly pinnate Lilies tulips and almost all grasses illustrate the third or parallel-veined type of leaves, but even in them the shapes of the leaves differ within extremely wide limits

Leaves are arranged to get the greatest amount of light, they may be in pairs (opposite), or in spirals or zigzags about the branch (alternate), or in whorls, many springing from one point, but no leaf ever closely overlaps another

The normal form of the leaf is broad and thin, but there are many modified leaves—the needles of the pine tree, the long ribbon-like grasses, the finely divided compound leaves of

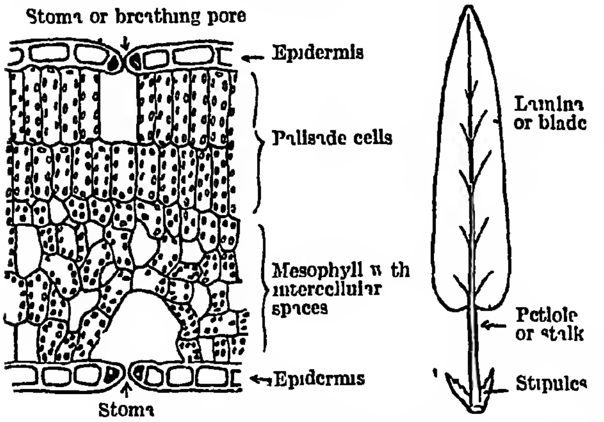


SOME OF NATURE'S MANY DESIGNS OF LEAF

Plant leaves exhibit almost infinite variety but they may be conveniently classified into a number of groups according to the way in which they are attached to the plant stem, their shape and their structure In this diagram some of the principal types are represented by plants characteristic of the flora of the British Isles

the tribe *Umbelliferae*, the hollow traps in which the pitcher-plant catches insects

Most leaves consist of two distinct parts the *petiole* or stalk attached to the stem, and the thin expanded portion called the *blade* Sometimes there is no petiole and the blade is attached directly to the stem, when it is said to be *sessile* Many leaves grow from between a



THE LEAF EXPLAINED

In the left-hand drawing above we are shown what the inside of a leaf is like, highly-magnified On the upper and lower surfaces are two stomata, the breathing-pores through which the leaf gets its air , the palisade cells add strength, and the mesophyll conducts solutions The drawing on the right is labelled to show the essential parts of a typical leaf

pair of small appendages, called *stipules*, attached either to the base of the petiole or to the stem Some stipules remain attached during the life of the leaf, as in the apple In the grasses the lower part of the leaf folds round the stem for some distance and is called the *sheath*

Some of the different kinds of leaves have been mentioned above, but there are really a large number of quite well-marked types of blade, to which you will find reference made again and again Starting from the narrowest, we have, first, *linear*, the parallel-sided leaf like a blade of grass , *lanceolate*, ranging from a narrow leaf which is not linear, to a longish, quite broad leaf which comes to a sharp point , *ovate*, which is broader near the base than the top , *obovate*, which is broader near the upper part of the leaf , *cordate*, a heart-shaped leaf , *peltate*, in which the petiole comes up into the centre of the blade, as in the nasturtium , *hastate*, in which there are lobes running back on either side of the leaf-stalk , *sagittate* (arrow-shaped), in which the lobes running back are almost or quite as large as the main part of the leaf , *trifoliate*, a three-lobed leaf like that of the clover , *palmate*, in which a number of lobes radiate from the base of the leaf , *perfoliate*, where the actual stem runs through the middle of the leaf , and *pinnate*, where there are a number of opposite leaflets all the way up the midrib, as the main central vein is called Opposite leaves are sometimes joined at their base (*connate*)

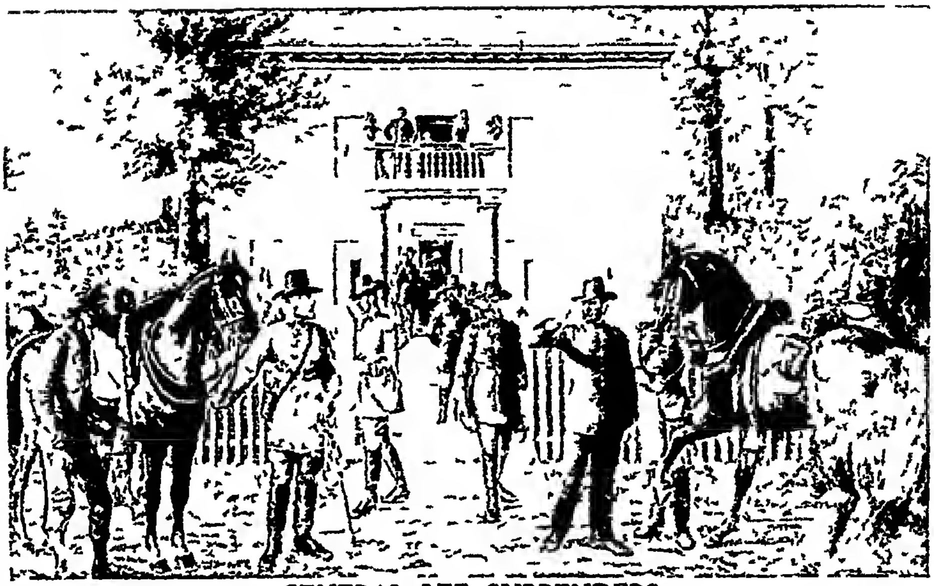
Besides these terms describing the leaf itself, there are others which refer to the margin This may be *entire*, or quite unbroken , *serrate*, with a saw-like edge , *dentate*, in which the margin is toothed rather than saw-like , *crenate*, with rounded serrations , and *lobed*, as in the oak leaf Finally, if the leaf has a single blade, it is called *simple* , if the blade is divided deeply, right down to the midrib, so that there are several distinct *leaflets*, it is said to be *compound* Thus, the horse-chestnut leaf is a compound leaf, palmately veined, with from seven to nine leaflets , and these leaflets, in turn, are practically sessile, obovate, with serrate margins, or *acuminate*, the term used for a leaf which narrows suddenly and runs into a more or less long point All pinnate leaves, of course, are compound, and sometimes the primary leaflets are divided up again, when the leaf becomes *bi-pinnate* , nor does it necessarily stop here, for there may be *tri-pinnate*, or even more compound leaves of this type Fern fronds, for instance, are like this There are several other terms referring to the surface of the leaf, but those given above are enough to enable you to understand the descriptions you come across in books on plants

Even the sepals and petals of a flower are modified leaves, though they have come to play

J J Ward

WHY LEAVES FALL IN AUTUMN

When autumn approaches, and the tree has no more need for its leaves, a layer of corky cells, tough and capable of keeping out the cold and wet, is formed across the base of the leaf-stalk This is called the abscission layer (seen magnified above), and by it the leaf-stalk is severed from the twig When the leaf falls, there is no ragged wound , only a characteristic "leaf-scar" shows where it was



GENERAL LEE SURRENDERS
This picture shows the last dramatic incident of the American Civil War which brought the fighting to a close General Lee (left) had been given supreme command of the Confederate forces only when it was too late to stave off defeat On April 9, 1865, he surrendered to General Grant (right) outside the Appomattox Court House, Virginia

a very different role from that of the true leaves The leaves of water plants show many interesting differences from those of land plants

Collecting leaves, either for their autumn colours or for their different forms, is a fascinating pastime They can be easily pressed out flat, labelled in ink on the leaf itself, and mounted in a blank book

In the autumn the leaves of deciduous trees—that is, those that lose their foliage every year—deck themselves in gorgeous crimsons, purples, browns, and golds These remarkable displays of colour are the result of life changes taking place in the trees themselves The tree is thrifty and a good manager, and when it feels the approach of autumn it not only puts on a thicker coat of bark over its twigs, but it gets ready to part with its leaves at the least cost

The first step is to withdraw to a place of safe keeping the precious chlorophyll This magic substance wears two coats, one green and one yellow, and all the summer the green hides the yellow one But in the process of being drawn back into the tree the green cloak goes first, leaving the yellow behind to give the beautiful autumn tints to the leaves

Also, while the chlorophyll is manufacturing food for the tree, it incidentally manufactures "glucosides," and other by-products for which, probably, the tree has little use When autumn comes, the tree grows a corky layer between the twig and the base of the leaf stem, so that there will be no wound when the leaf falls This cork door, which is called the *abscission layer*, shuts up the glucosides and other substances in the leaf, where they oxidize, and it is this process which creates the rich reds and browns of the autumn foliage (*See also* Plant Life, Tree)

Lee, General Robert Edward (1807–1870) "Massa Robert," as the great military leader of the Confederate States in the American Civil War was affectionately called, was born at Stratford, in Virginia, and educated for the army On the eve of the Civil War he had only the rank of a colonel, and in 1861 President Lincoln offered him the command of the United States forces But Lee was a Southerner, and so chose to fight on the opposite side

Lee was made one of the five full generals in the Confederate service In the spring of 1862 he was placed in command of the armies operating in defence of Richmond The masterly strategy which he displayed in the "Seven Days' Battles" showed him to be a commander of the highest ability

Lee then gathered together all his available forces and moved northward, his campaign ending with the battle of Gettysburg, which took place in the first three days of July, 1863 On the first two days of this battle the advantage seemed to rest with Lee's army, but on the third day he staked the issue on a grand charge, which was completely repulsed, and he was compelled to retreat

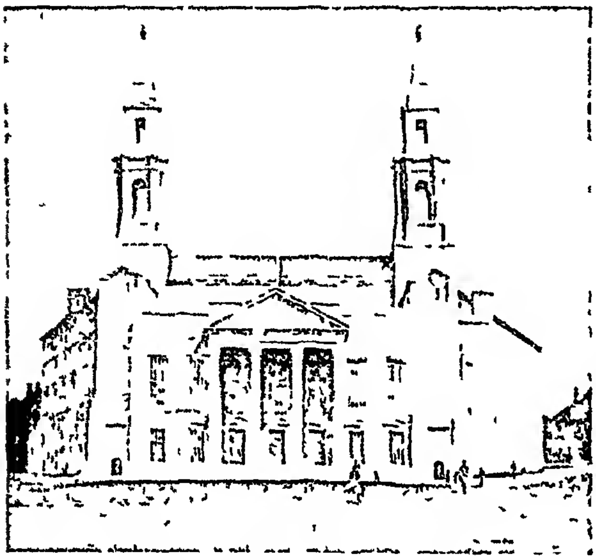
Early in May, 1864, General Grant took the field against him in person He attempted to turn Lee's flank, near the Wilderness, in Virginia, where occurred a two days' indecisive fight

In the spring of 1865 General Lee was compelled to abandon both Petersburg and Richmond He was still hotly pursued by Grant, and a few days later at Appomattox Court House his entire force surrendered and the war came to an end He died on October 12, 1870

Leeds, England For centuries England has been noted for the quality of its woollen cloths, the manufacture of which centres in Leeds—the sixth largest city in England, and the second largest in the county of Yorkshire

Leeds has been important in English trade ever since woollen manufacture was introduced in the 14th century It owes its commercial supremacy to two chief factors its splendid transport facilities and its situation on the edge of the great Yorkshire coal-fields The river Aire connects it with the east coast, while

the Leeds and Liverpool Canal provides cheap transportation to the west coast. The iron manufactures are nearly as important as the woollen. In the manufacture of boots and shoes, felt, ready-made clothing, artificial silk, glass, and pottery, Leeds also ranks high. Linen manufacture from flax grown in the Yorkshire region is another important industry.



CIVIC CENTRE OF LEEDS

This fine modern building is the home of the municipality of Leeds, and its handsome façade is seen to great advantage on account of the wide open space on which it stands. It was opened by King George V in 1933.

A trace of the interesting history of Leeds which goes back for 13 centuries, is found in the celebrated ruins of Kirkstall Abbey, a Cistercian foundation of the 12th century. Leeds is also noted for its university, its new Civic Hall (opened by King George V in 1933), and for the great music festival which is held there every three years. The population is about 482,000.

Legend. Students of folklore have found it convenient to distinguish myths (*q.v.*), which are explanatory stories invented to show how the world and the things in it came to be, from legends, which are popular history, containing an element of historical truth or, at least, the names of historical people. Sir Walter Scott used the word rightly in "A Legend of Montrose," for that novel, though not historically accurate in details, deals with historical people.

The story of how St. Patrick at a single stroke cleared Ireland of snakes is a legend, and similar marvellous stories grew up around many early saints. One of the first books printed by William Caxton, "The Golden Legend," was a collection of these stories. Legends have also been told of other great figures. The story of Alfred burning the cakes may be a legend.

An early and interesting legend tells us that Jesus visited England in the company of His friend Joseph of Arimathea, who was a merchant and may have come to Britain to buy tin. It is to this legend that the poet Blake refers in his well-known lines:

And did those feet in ancient time
Walk upon England's mountains green?
And was the holy Lamb of God
On England's pleasant pastures seen?

Legion. Few bodies of men have so long and so honourable a history as the legion. The word is derived from a Latin verb, *legere*, to pick out or collect. In Roman times legion was the name given to the major fighting unit of the Roman armies, and from those days to this, for over two thousand years, legions of one sort or another have been prominent in wars all over the world. Originally the *legio* was a citizen levy, defending the state against any enemies; later it came to be a highly organized army of from four to six thousand men. Mainly heavy-armed infantrymen and the picked troops of the Roman armies, the legion was the most dreaded war-unit of the ancient world. It is no exaggeration to say that to the organization and perfection of the legion Rome owed her Empire.

In the Middle Ages the word fell more or less into disuse, but gradually it came in again, chiefly for groups of mixed troops, often mercenaries fighting first for one country, then for another. From these developed the idea of the "foreign legions" of more recent times, such as those which served during the wars of the 18th and early 19th century in Europe. These were still more or less mercenary bodies, and often consisted of Scottish and Irish troops. Thus it was that the most famous of all modern legions of this type, the French "Foreign Legion," was at one time actually sold to Spain!

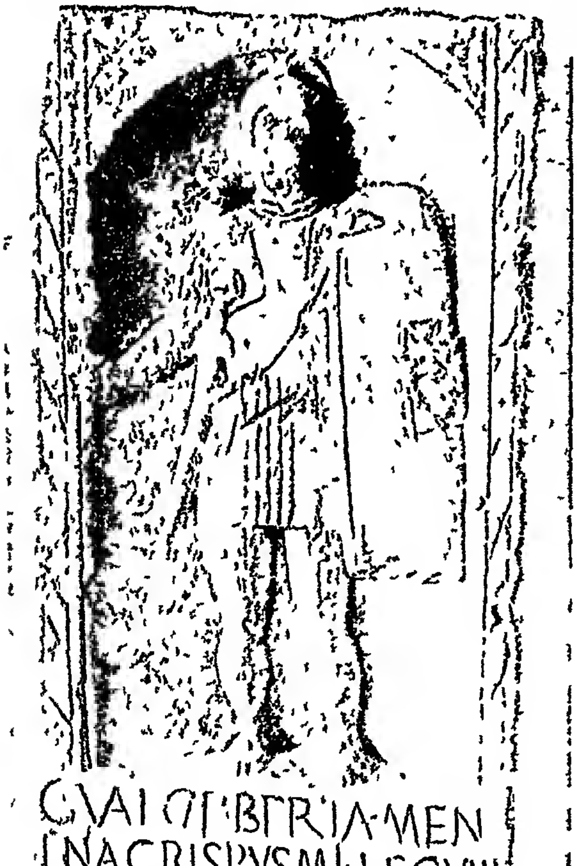
About a century ago the French Foreign Legion became organized, under the name of the *Regiments étrangers*, more or less on the same lines as today. It consists of some half dozen regiments of infantry and one of cavalry, distributed principally in Morocco, Syria, and French Indo-China. To these units is due the establishment of France's colonial empire. Life in "the Legion" is notoriously hard, although not more so than one would expect from any military body whose members worked under the world's most arduous physical and climatic conditions. For that very reason discipline is a mixture of severity in barracks and apparent laxity off duty.

The Legion attracts adventurers from all parts, but it is chiefly composed, curiously enough, of men from countries in which conscription is the rule. There are large proportions of Germans and representatives of most of the Central European races, as well as Frenchmen (who enlist as Belgians or Swiss since they are not normally encouraged in the Legion), and it is a fact that English and Americans are in various

ways, but especially temperamentally, less suited to the life than any other race Anyone other than a murderer may find safety in the Legion, at least from civil powers, but once there he must serve his term of five years The fact that a very high proportion of legionaries re-enlist for another five or ten years seems to prove that the many stories of its extremely brutal conditions are considerably exaggerated In 1934 the Legion accomplished the final conquest of Morocco, perhaps the greatest feat of arms to its credit

Another modern "Foreign Legion" is the International Brigade which played a conspicuous part on the Government side in the Spanish Civil War beginning in 1936

Still another use of the word legion is found in its application to associations of men who have served in the World War, such as the British Legion and the American Legion These seek to maintain contact between old soldiers, to help them to obtain work, and to keep alive their countries' traditions in times of peace



HERE LIES A ROMAN LEGIONARY

This gravestone stood above the grave of a Roman legionary It shows him armed with his javelin, shield, and the short sword which was so deadly a weapon in his hands against the barbarian By such legionaries the Roman empire was built

Wiesbaden Museum from Rostovtzeff Rome' Clarendon Press

Leicestershire. Situated almost in the centre of England, Leicestershire can claim distinction neither on account of its natural scenery, nor as one of the great industrial counties Yet in many ways it is a typical English county, and the very fact that it contains within its borders market-towns with such old English names as Market Harborough, Lutterworth, Ashby-de-la-Zouch, and Melton Mowbray indicates its links with the past

With an area of 823 square miles, Leicestershire is by no means negligible in a modern sense, however, and has become the principal centre of the ever-growing hosiery industry The county is a famous hunting district Leicester (population, 234,000), the county town, has been a cathedral city since 1926 Boots and shoes are made here as well as hosiery Loughborough, the only other borough, is noted for its training college and also for its War-memorial carillon and bell foundries Near Market Bosworth was fought the great battle between Richard III and the future Henry VII in 1485 Population of county, 550,000

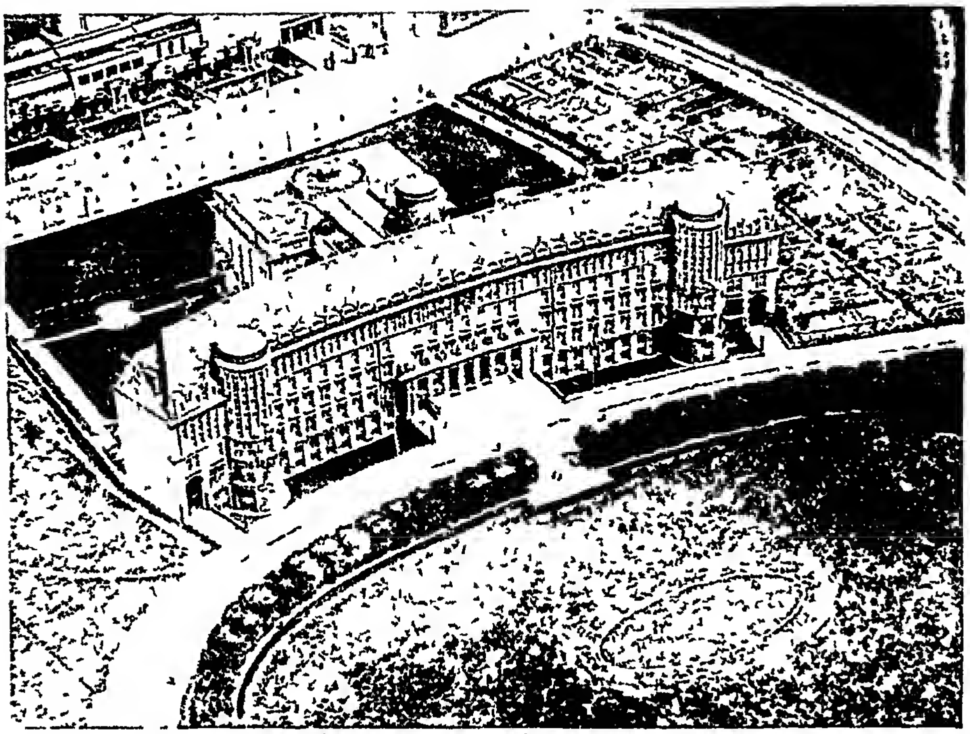
Leighton, FREDERICK, LORD (1830–1896) There is a refined and decorative elegance about the drawings and paintings of this famous president of the Royal Academy

Born at Scarborough, he studied for many years on the Continent before settling in London He was an accomplished draughtsman, producing numerous black-and white drawings for the most famous wood engravers of the time Some of his Biblical subjects, like "Cain and Abel," are among the finest book illustrations ever printed in this country

His paintings are notable for dignified and rhythmical design, but he lacked colour perception He was an accomplished sculptor, and many of the ablest critics of his day awarded him the highest position in that branch of art Leighton died on January 25, 1896, and was buried in St Paul's Cathedral

Leipzig, (Pron līp'-sik), GERMANY In Europe's many wars certain areas have been immemorial battlefields—the plains of northern Italy, the fields of Flanders, and the spot where the roads from western Germany and the central Rhine break through the Thuringian Forest to the plains of Saxony In this last place one may review in memory the campaigns of Gustavus Adolphus, of Frederick the Great, of Blucher and of Napoleon In this strategic spot—strategic for commerce and industry and culture as well as for battles—stands the city of Leipzig, the third largest in Germany, and the scene of Napoleon's decisive defeat in 1813 and of that "battle" of wits in 1519 when Luther debated his views with Johann Eck

Leipzig is above everything else today the chief German centre for the publishing and



LEIPZIG'S GREAT BOOK MUSEUM

Leipzig, as befits a city which is one of the great centres of German learning, is rich in libraries and museums One of the most interesting of the latter is the National Museum of German books, shown here In the collection are a series of specimens of books from the 18 towns that possessed printing-presses prior to 1471, and models showing the various processes of printing

Courtesy of German Railways Bureau

selling of books There are about 1,000 establishments engaged in this business The great book museum here is a Mecca for those who wish to know about books and their history The three great commercial fairs, or *Messen*, each year are the most remarkable survivals of what was a common commercial arrangement in the Middle Ages

The university, with its large student body, is one of the oldest and most important in Germany Leipzig is also a musical centre, and Bach and Schumann once dwelt there

Germany's Supreme Court sits in Leipzig The many monuments, imposing public buildings, huge railway station, and population of about 712,000 give evidence of Leipzig's importance The city lies in flat uninteresting country

Leisure. That leisure is a basic human need is common experience, "all work and no play makes Jack a dull boy" Nature works rhythmically, with alternating periods of activity and rest Both plants and animals require rest periods, and children, growing and at play, show such rhythms The problem is, however, how to direct the use of the greater leisure time which invention, science, and social education have made, and demanded, for the good of the generality of mankind today

The last century showed an almost world-wide tendency, particularly where machine industry gained a foothold, to reduce the hours of labour and consequently to increase leisure time In 1800 a twelve- to sixteen-hour day was common At

Fox Photos

TAKING THE FIELD FOR A CRICKET MATCH

These lads are not clad in orthodox cricket flannels, but in their equipment they are better off than those who have to make do with a coat for a wicket and face the bowler without the protection of pads They are starting out for the famous playing-fields of Eton College, which are now open to elementary school boys on Saturday mornings

the present time eight hours are considered a standard working day in most industrial countries, and there is a tendency to reduce the working period still further. Already a number of prominent British firms have established a five-day week of somewhere between thirty and forty hours, with beneficial results to their productive capacity and the health and happiness of their workers.

Leisure time has been increased by new methods of production in many industries. It is estimated that a man now produces ten times as much iron in one working day as formerly, five times as much timber, a hundred times as many nails, and ten times as much paper. A brick-making machine turns out 40,000 bricks a day, the former output of over 400 men. This same productive increase is seen in the case of farm work.

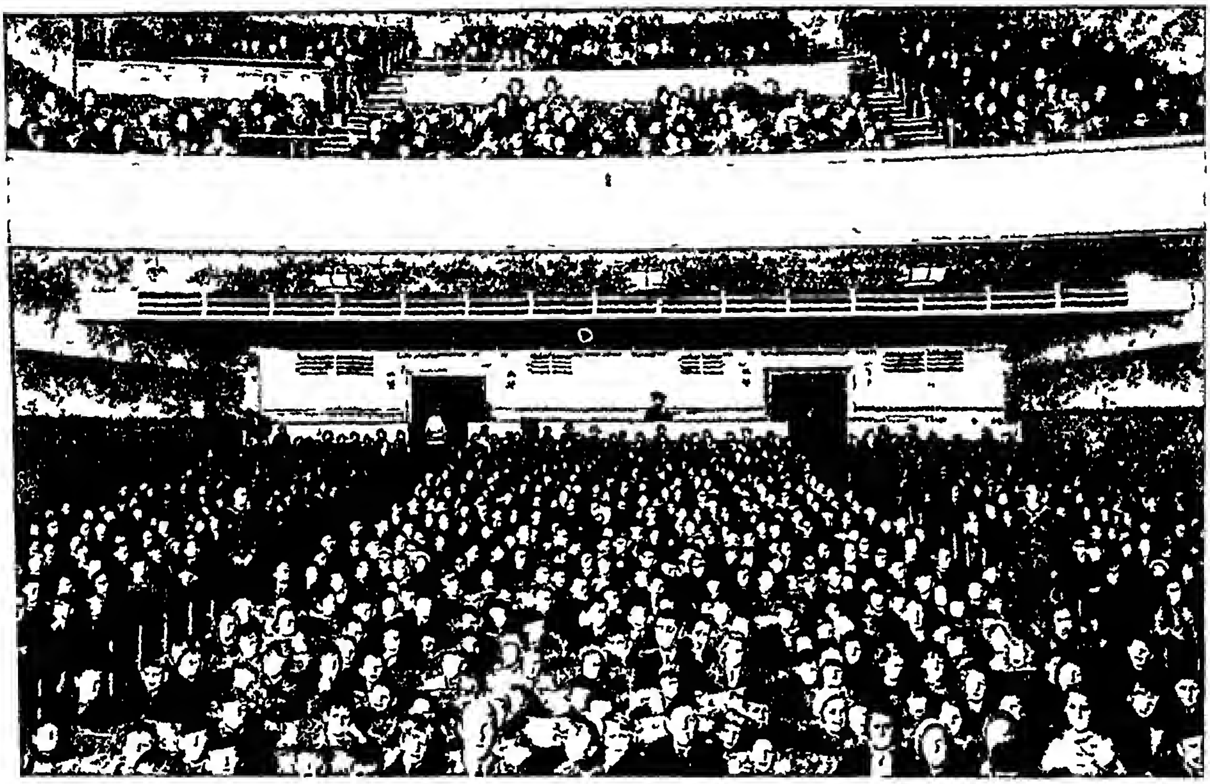
It is not only the worker's hours of labour that have been shortened, but also the housewife's. The machine age has revolutionized her work, and labour-saving and time-saving devices have speeded up such tasks as cleaning and cooking. Inexpensive factory-made clothing has released her from long hours of sewing. In cities, especially, changes in ways of living from large houses to flats have cut down tremendously the labour of keeping the home clean and tidy.

Before the machine age most leisure time was spent either about the home or in the near neighbourhood. Today the worker is likely to seek exciting amusements which take him out of the home and even out of his district. He wants the excitement of the club-house, the public park, the theatre, the cinema, the greyhound racing-track, or other places of commercialized recreation.

How do people spend their leisure time? On the answer depends largely the question whether or not leisure is good for us, individually and collectively. One recent inquiry showed that the ten activities most frequently engaged in were newspaper and magazine reading, listening-in, going to the "pictures," visiting or entertaining, reading fiction, motoring for pleasure, swimming, writing letters, studying, and just talking. The home still occupies an important place as a recreational centre, since the most common activities are engaged in at home, and the home apparently becomes more important as age increases.

In the future we are likely to have more leisure than in the past, therefore it is necessary that the young people of today should be "educated for leisure." The right use of leisure should be one of the objects of education.

Some fine beginnings in this direction have been made through reading, music and art



WAITING FOR 'THE PICTURES' TO BEGIN

Twenty million people of all ages while away two or three hours of their leisure every week at the cinema, and even quite small towns have their picture-palaces. Often special performances are given for the children, and then a comic film is always included. This crowded audience of smiling boys and girls is eagerly awaiting the beginning of such a performance which will almost certainly include one of Walt Disney's famous comic cartoons.

Courtesy of Odeon Theatres Ltd. photo H. L. Jarmon

appreciation, drama, sports and games, and courses in the manipulative crafts now organized in many of our schools. Pupils are early introduced to the delights of "free-time" reading, and we find them during their leisure hours eagerly reading not only good fiction but also interestingly written books of knowledge. Opportunities are given for creative work which discovers the talents of individual pupils, and in this way young people are encouraged to develop their various talents. Visits to museums and other institutions of this character are opening up the fascinating possibilities in this type of leisure-time activity. The suggestion of pursuing an interesting hobby is another activity that always brings enthusiastic response. And in all this education for the worthy use of leisure time, recreation and real play are not neglected. Every effort is being made to stimulate pupils' interest in the best kinds of sports, as witness the provision of playing fields under the King George the Fifth Memorial Trust. Likewise, young people are guided to choose the best pictures and other worth-while amusements from the many forms of commercial entertainment nowadays available.

Leitrim, COUNTY OF EIRE. Situated in the north-west corner of Connaught bordering Donegal and Fermanagh in Ulster, Leitrim is one of the most varied counties in Ireland. Picturesquely mountainous in the north, level and well-wooded in the south, where Lough Allen gives rise to the river Shannon, Leitrim is, however, a comparatively poor county. A few coal seams, thin and of poor quality, are worked, but employ a negligible number only. The soil is poor, except in a few small valleys, and grain crops are difficult and even unprofitable to cultivate. Potatoes and roots are the staple crops. Cattle, pigs, and poultry are reared, and coarse linen and pottery for domestic uses are manufactured in a small way.

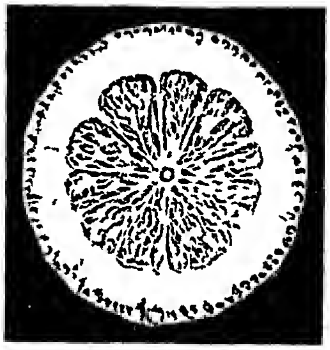
The total area of the county is 613 square miles and the population 50,876. The county town is Carrick-on-Shannon, with a population of only 1,000.

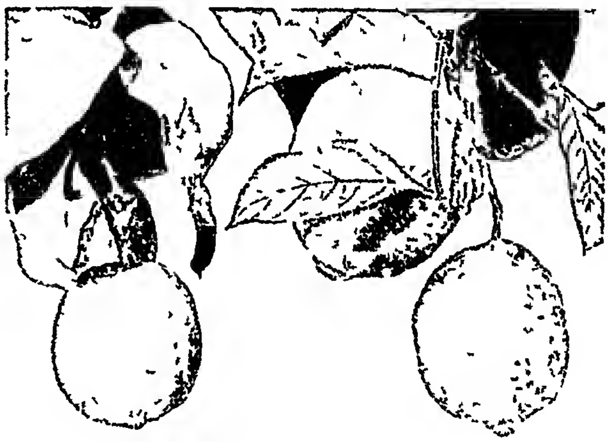
Leix, (Pron. lēs), COUNTY OF EIRE. Formerly known as Queen's County, but given its present name when the Irish Free State came into being, this fertile, gently-undulating county, with its dry, healthy climate, lies in the west of Leinster where it borders Tipperary.

On the east or Kilkenny boundary Leix embraces a large part of the Leinster coal-field, and here mining forms a valuable subsidiary industry to agriculture. The dairy farms and creameries of Leix are notable even in a country so completely agricultural as Ireland. Wheat, oats, barley, roots, and potatoes are the main crops but fruit-growing and market-gardening are not unimportant, Leix being remarkable among Irish counties in that its arable (or tilled) area is more than one half the area that is given over to pasturage or grazing.

The present name of the county is taken from the ancient district of Leix, where a small market-town, Abbey Leix, south of Portlaoighse, the county town, possesses the foundation of a famous Cistercian monastery of the 12th century. Leix is some 664 sq. miles in extent and has a population of 49,950. The county town, Portlaoighse (Pron. port-lē'-sha), formerly called Maryborough, has a population of about 12,000.

Lemon. This is one of the most important of all fruits in the summer time, and every one of us knows the delicious drinks which its juice and crushed flesh provide. The demand for lemons, one might almost say, increases by leaps and bounds as the mercury rises. Moreover, this cooling quality of the lemon has long been appreciated, and in Italy, Sicily, Corsica, and, particularly, in Spain and Portugal, lemon culture has been a large industry for many years.





THE LEMON AND HOW IT GROWS

Like other "citrus" fruits, the lemon has a fairly thick pithy skin round the juicy central part, and in the section at the top you see this, together with the arrangement of the inside. The lemons on a spray of the tree (bottom) are ready to pick.

Photos: top, Hinkins; bottom, L. Bastin

The lemon (*Citrus limonum*) is a close relative of the orange, but the straggling branches of the lemon tree show no resemblance to the compact dense foliage of the orange, and the purplish flowers have not the agreeable fragrance of the white orange blossoms.

If lemons ripen on the trees they lose their keeping quality, and so they are picked green

before there is any sign of the golden yellow colouring Each picker has a little ring $2\frac{1}{4}$ inches in diameter, and the fruit is cut when it can just slip through the ring From the moment the lemons are harvested they must be handled as carefully as eggs In dark storehouses, well ventilated but free from draughts, they are spread out and slowly ripened In curing the fruit shrinks a little, the skin becomes thinner and tougher, and develops a silky finish When the process is completed the lemons are washed, dried, and wrapped in tissue paper In this condition they will keep for months, which is a very good thing for the growers, as most of the fruit ripens in the winter and the great market demand takes place in the summer Under certain conditions, however, the tree flowers continuously and then it contains flowers and fruits in all stages most of the year

W S Berridge

RING-TAILED LEMUR

This is one of the most popular of the lemurs, for it lives happily in captivity—given a fair amount of room to bound about in—and becomes really affectionate after a short while See what long hind legs it has, enabling it to leap great distances, balanced by that wonderful tail

The lemon is used in more different ways than any other of the citrus fruits From the rind, lemon oil or extract, used in flavouring and in perfumery making, is obtained either by crushing or else by distillation, and candied lemon peel is made The pulp yields citrate of lime, citric acid, and lemon juice Besides its use in flavouring foods and drinks of various kinds, lemon juice is much used by calico printers to produce greater clearness in the white parts of patterns dyed with dyes containing iron

Lemurs. Small monkey-like animals, the size of cats and squirrels, with big eyes and rather sharp, foxy faces—such are the lemurs The name comes from the Latin *lemures*, meaning "ghosts," and is given to them because of their nocturnal habits, their shy, silent, ghost-like movements, and their love of forests and of the darkness

Lemurs are the lowest of the Primates, the group which also includes monkeys, apes, and Man Most of them have tails, but they cannot hang from trees by them as some monkeys can

With their numerous relatives lemurs form the group known as the *lemuroids* Of the ninety or so species of lemuroids fifty or more live in Madagascar All are restricted to the southern regions of the Old World—Africa India, Ceylon the Philippines, etc —but only in Madagascar and the Comoro Islands are the true lemurs found The better-known species of these curious little creatures include the beautiful but noisy ring-tailed lemur (*Lemur catta*), whose bushy tail is marked with alternate rings of black and white, the large *indri* (*Indris brevicaudata*) or babakoto ("little old man") of Madagascar, the dark iron-grey "gentle lemur," which frequents the bamboo jungles, and the "aye-aye" of Madagascar, so named from its cry The ring-tailed lemur, which, like most of its genus comes out more by day than by night, makes an excellent pet The aye-aye (*Chiromys madagascariensis*) is a funny little creature whose enormous canine teeth and long middle fingers are adapted to extracting grubs from their tunnels in timber The Indo-Malayan group of lemurs include the various species of loris, such as the slow loris (*Nycticebus tardigradus*), all of which move about in a curiously deliberate manner These little creatures are thought to have great mystic powers as love or good-luck charms Fossil remains of lemuroids are found in many lands, including North America Lemuroids in general eat leaves, fruits insects, small reptiles, birds, and birds' eggs (*See* Monkey)

Lenin, Nikolai (1870-1924) When the "Red Terror" of the Bolsheviks was raging in Russia in 1917-18, a short stockily-built man, bald-headed, with steel-grey eyes sat within the Kremlin at Moscow directing the activities of the Soviet government, of which he was the head It was Lenin, whose real name was Vladimir Ilyich Ulianov Although the son of a councillor of state, he had been a revolutionist since his youth When he was 17 years old his brother was hanged for plotting to kill the Tsar, and when he was 26 he himself fell into the hands of the imperial government and was exiled to Siberia Following the expiration of this sentence, being forbidden to reside in any of the large cities of Russia, he lived in Munich, Brussels, Paris, London and Geneva He became widely known through his authorship of several scholarly but radical works on economic topics After 1903 he was the recognized

leader of the wing of Russian Socialists who called themselves Bolsheviks

When the government of the Tsar was overthrown in 1917, he returned to Russia, and replaced the mild Socialist government of Kerensky with one of extreme Radicalism He did this with German aid and money A high officer of the German staff after the War acknowledged "the valuable service Trotsky and Lenin gave us," and declared that the German government had sent Lenin to Russia from the Swiss frontier and that "with our consent Lenin and his friends disorganized the Russian army"

LENIN

Lenin, whose real name was Vladimir Ilyich Ulianov, was a revolutionary all his life, and in his grim face and intense expression is apparent the determination which helped to make him one of the greatest figures of the modern world

Lenin favoured immediate peace with Germany to prepare the way for a world revolution directed against all capitalist and imperialist governments He called upon the working classes to rise up and seize control of the land and industries, and so establish the "dictatorship of the proletariat" The result was the Russian Soviet Republic, with himself as Premier and Leon Trotsky as Minister of War

Possessed of one idea to the point of fanaticism, Lenin showed himself a man of relentless determination and iron courage, free from all personal self-seeking

Lenin furnished the brains of the Soviet rule, as Trotsky furnished the fiery spirit and military organizations Lenin's numerous writings show him to be a man of learning with a remarkable grasp of the theories of revolutionary Socialism His driving energy finally wrecked even his strong constitution, and he died on January 21, 1924, at Gorky, near Moscow, after a severe attack of paralysis Lenin's grim granite tomb outside the Kremlin at Moscow has become a national shrine, the objective of pilgrims from all over Russia There his khaki-clad body rests in what appears to be a state of excellent preservation, the secret embalming process employed being said to be as perfect as the best ancient Egyptian method

Leningrad. When Peter the Great founded this city as the capital of Russia in 1703, he called it "St Petersburg," after his patron saint But during the World War the Russians disliked the German ending of the name, and changed it to "Petrograd," *grad* being a form of the Russian word for "town," *gorod* In 1924 the Bolsheviks changed it again to "Leningrad," in honour of Lenin

SOVIET SYMBOLS IN THE HEART OF LENINGRAD *Intourist*

The name of Leningrad commemorates the founder of Soviet Russia whose portrait is shown above, and this square in the midst of that fine city commemorates the victims of the Revolution to which the Soviet owes its existence The flower-beds are designed in the form of the badge of the Soviet, the hammer and sickle, while in the centre is the five-pointed star The fine old buildings of the pre-Revolution era, however, still surround the modern square

The site of the city, at the mouth of the Neva on the Gulf of Finland, has been important as a trade outlet from ancient times The country, however was a desolate marsh But Peter the Great was determined "I want a window to look out upon Europe," he said And so, in 1702, the "window" started to take shape Thousands of peasants died of disease and hardship as they sank the

piles for the city's foundation So many perished that the city is said to be "built upon bones"

Peter had travelled in western Europe, once working in England as a shipwright, and wanted his capital to be magnificent The major portion was to stand on a peninsula where the Neva curved to the northward, then turned south-west to the Gulf of Finland On the left or south-east bank of this last portion rose the Old Admiralty in a magnificent square Adjoining this square stood the Winter Palace, while across the river on an island lay the grim fortress of St Peter and St Paul The principal streets radiated from this centre, and included the Nevsky Prospekt, meaning "view of the Neva" The islands in the river were linked by bridges, and canals helped to drain the site Palaces were lavish, and a court life grew up, amid unbelievable extravagance

But there was also an abject poverty which contrasted strikingly with the brilliance of the court The atmosphere of the city was tense with repression, fear, contempt, and hatred, unrest grew rapidly There were strikes and revolts, until in 1917 came the two revolutions which finally established the Soviet state

The glamorous palaces and the fine houses of the aristocrats have now been converted to other uses Some are museums—museums of the bygone imperialism Some are hospitals, schools, day nurseries, or club rooms The colossal Winter Palace—the largest palace in Europe—has become the Palace of Art and Museum of the Revolution This mammoth building, which was begun in 1754 and completed ten years later, was the residence of the Tsars, and had accommodation for 6,000 people There are museums of Children's Welfare, People's Health, Home Industry, Applied Arts, Comparative Religious Thought, and many more The Nevsky Prospekt has become the Prospekt of the 25th of October, in honour of the Bolshevists' capture of the Winter Palace on that date in 1917

Leningrad in Recent Years

After 1917 Leningrad languished, but later a drastic effort was made to revive the city The government erected a number of new factories, and the population increased Production of textiles, rubber goods, and shoes grew enormously Metal and machinery manufactures increased Chemicals, clothing, paper, furniture, matches, tobacco, leather goods, and alcoholic liquors also were manufactured Other exports today include timber, tallow grain, flax, hemp, linseed, copper, bristles, vegetable oil, furs, leather, and skins

The Neva is frozen for six months in the year, and rain, snow, and floods are frequent, yet Leningrad is now Russia s chief naval base The population of the city is about 3,191,000

Lens.

If you take the lens of an ordinary magnifying glass and hold it to the sun in such a way that the rays of sunlight passing through the lens form a tiny bright spot on a piece of wood or paper, the wood or paper will start at once to smoke and smoulder, and, if the lens be held in position long enough, flames will burst forth In the "burning-glass" experiment all the rays of sunlight which pass through the lens are bent and their heat is concentrated upon a single point, called the *focus*

But it is not as "burning-glasses," that lenses are chiefly useful Their power to bend and focus rays is used principally in telescopes, microscopes, spectacles, and cameras, to focus the light rays rather than the heat rays

MAGNIFICATION WITH A LENS

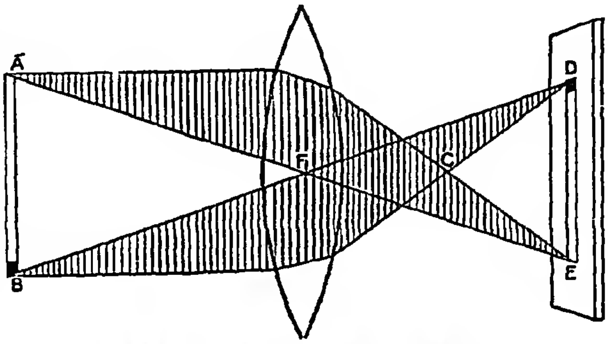
This illustration shows the simplest form of lens, a magnifying glass With the lens held close to the object the butterfly, seen on the leaf which is being examined appears to be the size indicated on the extreme right of the picture

Most of these principles of the lens can be demonstrated with an ordinary magnifying glass Hold it close to some small object, and the object will appear much larger than it is Hold it at arm's length and look through it at some distant object, and the object will appear upside-down and much smaller Go into a dark corner of a room and let the light from the window shine through the lens upon a piece of paper By moving the lens backwards and forwards, you will soon be able to cast upon the paper an inverted image of the brightly lighted window and the scene outside

The accompanying diagrams explain these differences in the action of a lens We must remember that even after a ray of light has been bent out of its course, it still *appears* straight when it falls upon the eye Above, we see the effect of plain magnification The rays from the object coming together at the eye seem to the eye to have come from an imaginary and much larger object

The manner in which the inverted image is formed on the white paper is a little more complicated We assumed just now that all the rays of light from the object were parallel

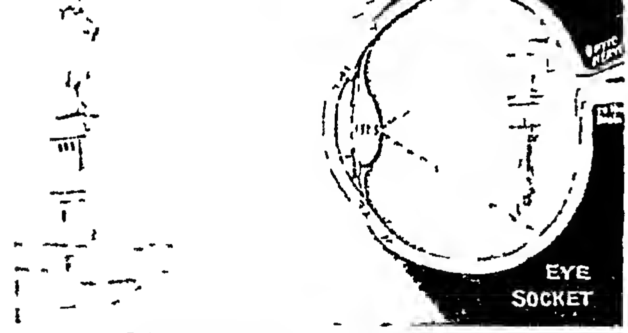
to one another In fact, of course, light rays spread out in every direction from any lighted point as shown on the right From the points *A* and *B* parallel rays pass through the lens and are bent so that they cross at *C* But other rays from *A* and *B* pass through what is called the *optical centre* of the lens at *F* These are not bent, but pass straight onward, and meet the first two rays at *D* and *E* It is at this meeting-place or "focus" that the image of the object *AB* is made on the paper, only that it is now upside-down, the point D now corresponding to *B* and *E* to *A* Of course, rays from every other part of *AB* do the same thing and form a corresponding part of the image *DE* The plane on which the different points of the image come to focus is called the *focal plane*, and it is in this plane that photographic plates are mounted



How an inverted image is produced

The magnifying lens we have been considering is only one of many forms Its two sides are sections of equal spheres, and such a lens, which is always thickest in the middle, is known as a double-convex lens Other lenses may have both sides concave and thus be thickest at the edges These are known as double-concave lenses Again, one side of the lens may be flat and the other concave or convex, in which case the lenses are called plano-concave and plano-convex respectively

In general, the concave lenses, instead of converging the rays of light to a point, spread them out or disperse them in just the opposite way For this reason objects seen through a double-concave lens appear right side up and smaller than they really are By varying the curvature of the surfaces of lenses differences in focal length are obtained, that is, differences in the distance between the optical centre and the focus They may be ground also to throw distorted images, as in the case of spectacle lenses, which are adjusted to combine properly with the lenses of the eyes If the shape of the eye lens is distorted by what is called "astigmatism," the spectacle lens is distorted in the opposite manner, and the combination of the opposed distortions produces a normal image on the retina This is accomplished by combining in one form a spherical and a cylindrical lens in what opticians call a compound cylinder (*See* Spectacles)



LENS ACTION OF THE EYE
Here is shown how the human eye contains a lens and a screen The image on the screen (retina) is inverted because the lens is a double-convex

The general optical law which governs the use of lenses is called the law of the refraction of light, and it may be summed up as follows When a ray of light passing through a lighter medium (air) strikes the surface of a denser medium (glass) at an oblique angle, the ray is bent or refracted *towards* the perpendicular to that surface, and when it passes out again from the denser glass to the lighter air, it is bent *away* from the perpendicular

Lenses are combined in optical instruments for various purposes For instance, the enlarged image produced by one magnifying glass may be passed through a second lens and enlarged again, giving us the principle of the microscope

For accurate work lenses are usually made of two or more layers of different kinds of glass closely cemented together This is done to correct colour aberration or the tendency that any special kind of glass may have to separate the light rays into colours and so form an imperfect image, or one surrounded with colour

The manufacture of high-grade lenses is one of the most delicate of all mechanical operations The immense glasses used in big telescopes require months and even years of preparation The surface of a lens is shaped by grinding the glass in an iron mould Finer and finer grinding materials are used, ending up with a red iron peroxide called "rouge" which gives the lens its high polish (*See also* Photography, Telescope)

Lentil. This food plant (*Lens esculenta*), akin to the bean and pea, and belonging to the order *Leguminosae*, is said to be one of the oldest cultivated by Man, and it is still an important article of food in Egypt, Syria, Mexico, etc The seeds, which are round and flat and less than half-an-inch in diameter, are made into soup or eaten boiled But the reddish little 'lentils' you usually see in Britain are only 'half seeds', for in Nature two of them, with the flat sides

together form each seed, covered with a greyish skin The "pottage" for which Esau sold his birthright is said to have been made of these seeds The vines, as the plants themselves are called, make excellent fodder for cattle and sheep

Leo. POPES The first of the thirteen popes of this name is well called LEO THE GREAT (Pope, 440–461), because of his learning and the important part which he played in the theological controversies of the time LEO III (Pope, 795–816) is chiefly remembered because it was he who placed the imperial crown on the head of Charlemagne, on that memorable Christmas Day of the year 800 (*See* Charlemagne)

LEO X (Pope, 1513–1521) was a member of the rich Medici family of Florence He was elected Pope on the death of Julius II, at the age of 38 His reign saw the beginning of Luther's revolt against the Church, increasing danger to eastern Europe from the Turks, and a continuance of the political struggles and wars involving the Papacy begun by his predecessor But Leo X is chiefly remembered for his part in the Italian Renaissance, as the liberal patron of Raphael and other artists and of numerous scholars, poets, and other literary men It was he chiefly who made Rome the successor of Florence as the literary and artistic capital of Europe

LEO XIII (Pope, 1878–1903) the latest to bear this name, became Pope at a time when the Papacy had recently been deprived of its "temporal power" as ruler of Rome and the surrounding country Like his predecessor, Pius IX, he refused all offers of compromise with the new kingdom of Italy, and remained a "prisoner" in the Vatican

Leonardo da Vinci. (Pron lē on ah'r dō dah vin'-chē) (1452–1519) If you can imagine many geniuses residing within one personality, you may then have a faint idea of the magnitude and versatility of this most extraordinary man Of the three Italian giants of the Renaissance—Michelangelo, Raphael and Leonardo da Vinci—Leonardo stood for more than a mastery of art, and there is no doubt that he is one of the greatest figures in the history of the Western world In the realms of mathematics, science, and engineering his mind was one of the keenest the world has ever known Curiosity and the love of the uncommon were the ruling passions of his life

Born at Vinci, near Florence, Leonardo died near Amboise, in France During his lifetime he visited most of the great cities of Italy—Florence, Milan, Venice, Rome—working in all of them at painting or architectural projects

LEONARDO PAINTED BY HIMSELF

In this superb self-portrait we have the likeness of Leonardo da Vinci, one of the greatest figures the modern world has known Eminent alike in art and science, Leonardo was as handsome as he was brilliant This fine painting hangs in the Uffizi Gallery, in Florence

Leonardo served his artist's apprenticeship as the favourite pupil of Andrea del Verrocchio When 20 years of age he became a member of the painters' guild, and for the next ten years he practised his art in Florence, in the golden days of Lorenzo the Magnificent of the house of Medici Much of his later life was spent in Milan in the service of Ludovico Sforza, a short period in that of Caesar Borgia, while his last years were passed in the employ of Francis I

It is chiefly as a painter that Leonardo is remembered He made great changes in the technique of painting, for to him light and shade were as important as colour to other artists But what makes Da Vinci's art unique is his ability to express the whole range of hidden emotion He shows also a rare knowledge of Nature

Two of the master's paintings are among the greatest masterpieces of the world—the "Mona Lisa" a portrait in oils which is one of the treasures of the Louvre, and "The Last Supper," a large wall painting on plaster in "tempera"

This latter picture, which is reproduced on page 219 of this work, was painted on the wall of the refectory of the convent church of Santa Maria delle Grazie at Milan The disciples, with the Master in their midst, are represented at one side of a table, their faces to the spectator The words, "One of you shall betray Me," have just been spoken

As a painter, etcher or draughtsman, Leonardo was perfecting the work of others, carrying their

ideas further and putting his own theories into practice But as a scientific investigator he worked on his own account, a pioneer in a land where no man had travelled He made discoveries of primary importance in both applied and theoretical science In dynamics, in aeronautics, anatomy, engineering, he was hundreds of years ahead of his day, and had his followers realized the importance of the work which they took for the master's mere recreation, the whole history of science would have been vastly different Even Leonardo's flying machine, it is said, could have flown had he but had a source of power such as the petrol engine

Yet it has only been in the last hundred years or so that any attempt has been made to publish his manuscripts, or to discover just how far Leonardo got in his innumerable researches into every branch of knowledge Only his famous treatise on painting was published under his own name within a comparatively short time of his death Yet, in spite of all this, we have enough, in his few paintings, to show how great a man was Leonardo, while a short glance at some of the great collections of his drawings, or a brief acquaintance with some of the many fine books about him, will show that Leonardo does indeed deserve to be classed among the world's very greatest men

Photo Mansell

A SUPERB LEONARDO CARTOON

This lovely "cartoon"—the chalk drawing for a picture—by Leonardo da Vinci, hangs in the Diploma Gallery of Burlington House, London Known as "The Madonna with St Anne", it is typical of Leonardo's religious work, the faces of the sitters being immediately recognizable, by the natural sweetness and beauty of expression, as coming from the master's hand The finished painting is in the Louvre, Paris

Leopard. You may sometimes be confused as to which is which among the various black-and-yellow-spotted members of the cat tribe, and especially when it comes to distinguishing between the leopard and the jaguar But it is quite easy if you remember that the leopard (*Felis pardus*) has smallish, solid black spots, while the jaguar's are large, often ring-like, and more like four- or five-sided markings than spots This spotted animal of the cat family inhabits Africa, Asia, and the large islands of the Malay Archipelago It is smaller than the jaguar, being about four feet long with a tail three feet in length There is considerable variation among leopards as to size and colour They are usually pale fawn or tawny colour with dark spots The under surface of the body is somewhat lighter in shade The larger forms of southern Asia are commonly called "panthers" The leopard lives in the forests, and is a tree-climber It is agile and a remarkable jumper It attacks the antelope, young cattle, pigs, and, occasionally, Man

The cheetah or hunting leopard (*Cynaelurus jubatus*) of India is a slim species which is tamed and trained to aid in hunting In 1937 some of these animals were brought over to England and trained to race after the manner of greyhounds The ocelot (*F pardalis*) is another leopard-like cat, with striped and spotted fur, found

in tropical regions of America It is a very handsome creature, but not so fine as the rare clouded leopard (*F nebulosa*), an arboreal species from the Himalayas and Malaya Another fine beast is the ounce, or snow leopard (*F uncia*), a fierce Himalayan cat which is also rare It has long, thick fur

Leopold. BELGIAN KINGS There have been three Kings of the Belgians — not of Belgium, please note—of the name of Leopold

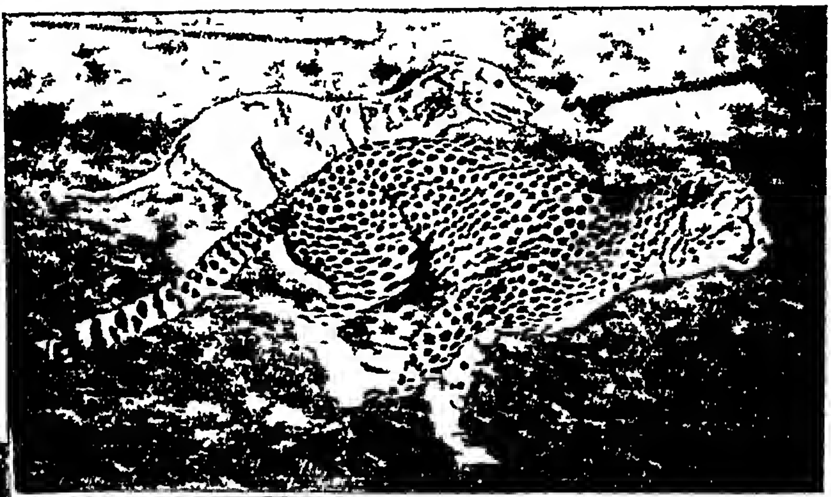
LEOPOLD I (1790–1865) was the brother of our Queen Victoria's mother, and his first wife was Princess Charlotte, the only child and heiress of King George IV He married her in 1816, after he had returned from serving in the war against Napoleon, but a year later she and her new-born son died If she had lived she would have succeeded to the throne—and Queen Victoria might never have been born! (It was as a result of Charlotte's death that her uncle, the hardened old bachelor, the Duke of Kent, got married so that there might be born an heir to the throne, Victoria was born in 1819)

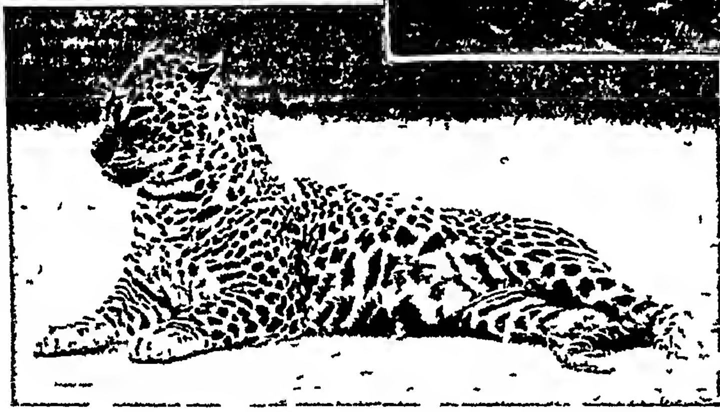
Throughout his life Leopold was the trusted adviser of the young Queen Victoria, and it was on his advice that she married his nephew and her cousin, Prince Albert of Saxe-Coburg

Leopold was elected King of Greece in 1830, but abdicated after a few months Then in the next year he was elected first King of the Belgians, and until his death he ruled his little country wisely and well

He was succeeded on the throne by his son LEOPOLD II (1835–1909), during whose reign Belgium grew immensely in wealth and prestige Leopold was remarkably shrewd, and in politics and in finance he was almost always highly successful

When Stanley (*q v*) returned from Africa after having explored the Congo Basin, Leopold was clever enough to grasp the value of his discoveries, and courageous enough to back the explorer with money and necessary means for developing the great tracts of the Congo basin in western Africa





LEOPARD AT REST CHEETAH AT SPEED

The leopard, one of the finest of the spotted members of the cat tribe (directly above) is distinguished from the jaguar by the fact that its spots are simple, not ring-like The cheetah (upper photograph) is here seen racing with a greyhound, in India it is trained for hunting gazelles

Photos Topical Gambier Bolton

As a result of this personal speculation the huge Belgian Congo became King Leopold's private preserve, as we would say today, and from it he made an enormous private fortune But in the process shocking atrocities were perpetrated on the unfortunate natives, and at length there was such an outcry throughout the world that in 1904 a Commission, to which Leopold assented, was appointed to inquire into the government of the Congo territory As a result of this inquiry, Leopold agreed to hand over his private interests to Belgium, and in 1908 the Congo Free State became a colony of Belgium, since when conditions there have been steadily improved (*See* Congo States)

Leopold II is justly entitled to be regarded as the true architect of modern Belgium's prosperity, and no matter how much his rather dissolute life as an individual may be censured, no impartial student of history can gainsay his strength of character

He died December 17, 1909, and, as he left only daughters, was succeeded by his nephew Albert (*q v*), the heroic king who defended Belgium's soil against Germany from 1914 to 1918 He in turn was followed by his son, LEOPOLD III

Born November 3, 1901, King Leopold loves Britain well, for it was to this country that he came to be educated, and it was from the "playing fields of Eton" that he returned,

when a mere lad to serve his country in the trenches against Germany, as a private soldier of the Belgian 12th Regiment

Leopold III came to the throne on February 19, 1934, and it was not long before he showed the same good qualities as distinguished his father In the post-slump years, when trade depression, currency restrictions and political disorders changed international relationships and led to dictatorships abroad, Belgium was well served by her young sovereign

In its personal or family sphere Leopold's life has been marked by tragedy He was but a boy when the World War broke out, his father was killed while rock-climbing in 1934, and, to crown all, there came on August 17, 1935, the death of his wife and Queen, the beloved Swedish Princess Astrid, who was killed whilst motoring with him in Switzerland

There are three children of the marriage Princess Josephine, Crown Prince Baudouin (born 1930), and Prince Albert

Letter-Writing.

'I feel as though I were talking to you,' wrote Cicero to a friend nearly two thousand years ago That is the way to feel when you are writing friendly letters

Letters as a mere form of communication began long before Cicero's time More than a thousand years before his day the rulers of western Asia were keeping up a lively correspondence with the pharaohs of Egypt A collection of some 300 of their letters written on clay tablets was dug up at Tell-el-Amarna Egypt in 1887 From Homer and Herodotus we learn that the ancient Greeks sometimes sent letters But it was left for the Romans to develop letter-writing into an art, since their able men had to spend years in governing distant provinces and could learn what was happening at Rome only from the letters of their friends

KING LEOPOLD III IN LONDON

This photograph illustrates the arrival of King Leopold of the Belgians at the Guildhall, London, in November, 1937 He is here seen inspecting the guard of honour formed by the Honourable Artillery Company

Two of the most famous letter-writers in the English language are William Cowper, the poet, and Charles Lamb author of the "Essays of Elia" and "Tales from Shakespeare" Neither led an exciting life, but they had an affectionate interest in their correspondents, and found delight in writing about everyday scenes and events Jane Carlyle, wife of the famous Thomas Carlyle won a place in literature by her lively letters Another woman remembered for her letters is Madame de Sévigne, a Frenchwoman of the 17th century Robert Louis Stevenson wrote delightful letters, and, to come nearer our own time, there is the correspondence between Bernard Shaw and Ellen Terry

Reading such letters will not only entertain you—for who does not enjoy reading a lively personal letter ?—but will also inspire you to write more readable letters yourself

The Etiquette of Letter-Writing

Unruled paper, white or pale grey, blue, or buff, is in good taste for social letters Fashions in the shape and design of letter paper change slightly from time to time, but paper of fantastic design should never be used

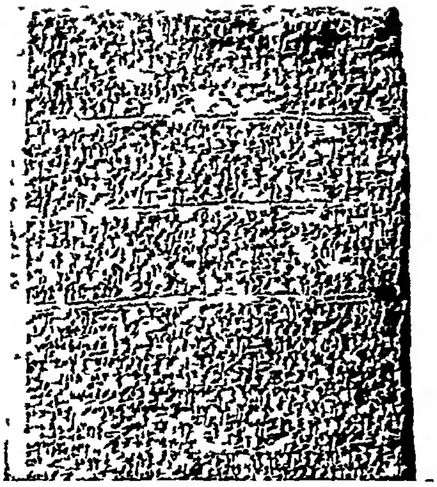
Good form also requires that letters be written in blue or black ink, not in pencil, that margins be left at both sides and at the top and bottom of the page, that no abbreviations (such as A M or Tues) and no figures be used in the body of the letter, for they give an impression of hastiness which is impolite The date and the sender's address should never be omitted The usual place for them is in the upper right-hand corner of the first sheet

In writing to a mere acquaintance or to someone you have not met, you would probably begin, 'Dear Mrs Sterling", to a friend or a relative you would say "My dear Mrs Sterling," or, still less formally, "Dear John" or perhaps more intimately Dearest Mary' The correct end for a letter which opens formally with "Dear Mrs Sterling" is "Yours sincerely A more intimate letter may end with Affectionately yours,' 'Lovingly yours," or with some other variation which appeals to you 'Yours faithfully" or "Yours truly" are commonly used in business letters Whatever -*ly* word you use, *yours* should precede or follow it 'Sincerely John" is not grammatical

Except in letters to members of your family and to intimate friends, the proper signature is your surname preceded by your initials or by one of your Christian names

The start of a letter is important, just as first impressions are important in our contacts with

people Beginning with an apology such as, "I meant to write to you before, but I haven't had time," is uninteresting It would be pleasanter to say, "I am glad today is a holiday, so that at last I have time to write you" There is nothing amiss in beginning with "I," but a letter that is peppered with I's appears too full of self Turning a sentence round will often make the I's less conspicuous Instead of "I received your letter I was glad to hear from you," you might say, "You were good to write me that jolly letter while I was ill"



A LETTER 3,300 YEARS OLD

Some of the earliest letters known are the baked clay tablets discovered at Tell el-Amarna in Egypt Above is part of a letter from a king of Mitani, to Amenhotep III (about B C 1400)

British Museum

Too few I's are nearly as bad as too many Chopped-off sentences, such as "Was glad to get your letter" and "Hope you are better," are not grammatical and are abrupt as well

Among the special kinds of letters which must be written from time to time, letters of thanks come first Writing these promptly shows one's appreciation and is certain to result in more enthusiastic letters

The "bread-and-butter letter" is the one sent to one's hostess after a visit When you have spent a few days at the home of a chum you should write shortly after your return home not only to this friend but also to the mother of the household

Occasionally you will receive a formal invitation to a party or wedding, written or engraved in the third person In this case your reply is also written in the third person An acceptance usually begins "Miss Brown is pleased to accept the kind invitation of" and then follows closely the wording of the invitation By mentioning in your acceptance the date and place and also the hour stated in the invitation, you tell your hostess that you have carefully noted the time and place of the party Use white note-paper four by five inches in size Never sign or date a formal reply

When you receive a wedding invitation asking you to the church ceremony only, you need not reply But if you are invited to be a guest at the wedding breakfast or reception, you must send an answer

How to Write a Business Letter

A business letter must above everything else be clear and to the point, but it cannot be effective unless it sounds as natural as talk Stilted expressions take all the life out of a letter The roundabout "I beg to acknowledge your favour" and the formal close prevalent in Charles Lamb's time, "I am Sir, with great respect, your humble servant" are equally out of fashion

Unnecessary words and insincere phrases are also avoided by good letter-writers For example, 'Enclosed is' or I am enclosing' is preferable to 'Enclosed herewith' "Your letter or your order" is simpler than "your esteemed favour' And We are pleased to advise you' is both pompous and useless

In business letters it is important to include both the *heading* (the date and the address of the writer) and the *superscription* (the name and address of the person or the company to whom the letter is written)

Following the superscription, a letter to a firm may begin either with "Gentlemen or more usually in Britain with Dear Sirs"

In conclusion just a few words on the right way to address an envelope Envelopes addressed to friends and business acquaintances etc, should read as follows

Mr George Smith (*or* George Smith Esq,)
14, Carpenter Street
Hudville,
Blankshire

N B *Never* write Mr George Smith Esq

When writing to a business firm address as follows

Messrs A B Smith & Co
Butcher s Row
Blankville

Writing to clergymen you should address Rev J G Smith, M A, to a married lady, Mrs Jones (*or* Mrs John Jones where John is the name of her husband, and there is another Mrs Jones in the same family), to an unmarried lady, Miss Jones *or* Miss Mary Jones to a small boy, Master Jimmy Jones

Liberals. Someone has said that Jeroboam, the king who revolted against King Solomon s son was the first Liberal and certainly the Liberals have always been notable for their advocacy of reform in politics economics and social affairs generally At first they were called Whigs, but since 1830 they have been known as Liberals Perhaps the greatest Liberal Prime Minister was W E Gladstone who was four times Premier under Queen Victoria, other great names in the Liberal pantheon are Charles James Fox, Richard Cobden, John Bright, H H Asquith and David Lloyd George

Since the War of 1914-18 the Liberal Party has fallen on evil days and its place as the pro-

gressive party has been largely taken by the Labour Party, which was founded in 1900 Another factor making for its decline is the settlement of many of the questions, e g, fiscal policy, home rule for Ireland, Church disestablishment and franchise extension, with which 19th-century Liberalism was identified It is claimed, however, that there is a large body of Liberal opinion in the country which cannot make itself felt owing to the fact that our present electoral system was designed for two parties and not three

Liberia. This negro republic on the west coast of Africa—now the only independent state in the whole continent if we accept Abyssinia as Italian territory—lies just north of the Equator, and was founded in 1822 by the American Colonization Society as a refuge for liberated slaves from the United States Its constitution and flag are modelled on those of the United States, and Monrovia, its capital, is named after President James Monroe

The Liberians proper—the civilized and Christian descendants of American negroes—number about 12,000 and live in a few settlements on the coast or a few miles inland There are also about 50,000 "coast natives," who are partly civilized, and between 1,000,000 and 2,000,000 "bush niggers," living in the forests of the interior, who belong to many different tribes and speak only their native tongues The country has about 350 miles of coast line, its area is about 43,000 square miles Five-sixths of it is covered with dense tropical forests, from which are obtained the country's chief exports—palm oil, palm nuts, piassaba fibre and rubber Coffee and cocoa are raised

Liberia possesses great natural wealth, including iron, gold, copper, and other minerals, but there are no railways Owing to the difficulties of communication the interior of the country is as little known to the Liberians as to the world at large The climate has been called the hottest on the globe

In consequence of cruelties perpetrated on the natives an international commission of inquiry was sent to the country in 1931 Promises of reform were made and a scheme of assistance was prepared Even now, conditions in Liberia are far from satisfactory, and the League of Nations is being periodically urged to hasten much-needed reforms

LASS OF LIBERIA

This young woman is a Kru, a negro people of Liberia She has exceptional charms, for most of the women of Liberia are very unattractive, and she is also more stylishly gowned than most

Area —43,000 square miles, total population, between one and two millions
Physical Features —Mountainous and forested in the interior, coastal lowland
Principal Products —Ebony, mahogany, teak, and other woods, rubber, coffee, cocoa, palm products
Chief Town —Monrovia, capital (10,000)

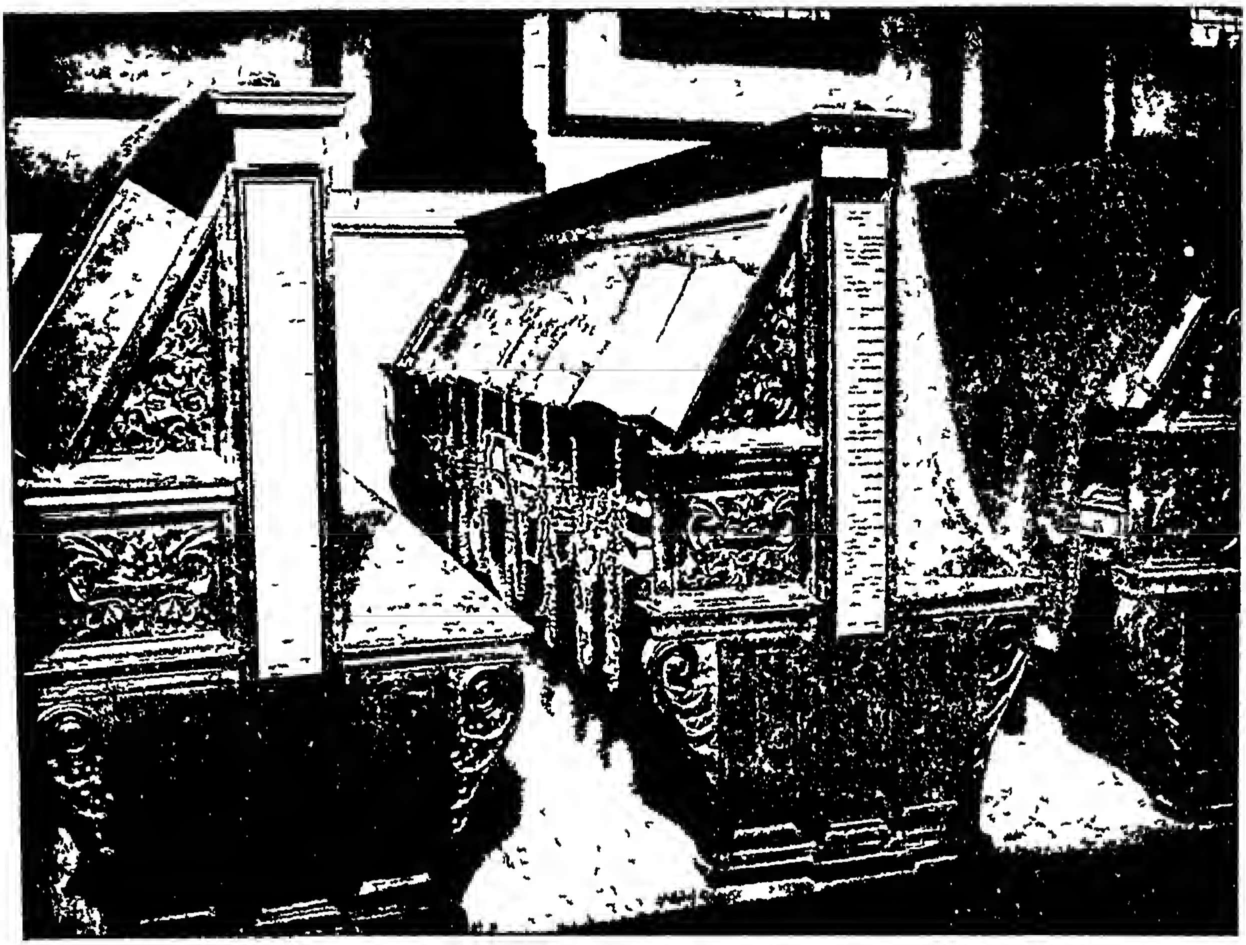
Library. To obtain books from a public library for home reading one must secure a card, either by signing a pledge to obey the rules, or by obtaining the signature of some responsible person who acts as guarantor

There are a few simple devices which serve as keys to the library's stores The most valuable is the card catalogue, alphabetically arranged by author, title, and subject If you wish for a particular book and know the author, look for his name and you will find after it all of his works that are in the library

Perhaps you wish to gather information on some large subject, such as Aeroplanes Look under this heading and you will find a long list of books from which to choose After each book you will see the catalogue number, and, proceeding to the shelves (presuming that the library is on the "open access" system), you will be able to see whether the book is "in" or not

Libraries—by which is meant either collections of books or the places where they are kept (from Latin *liber*, meaning "book")—are almost as old as civilization More than 600 years before Christ, King Ashurbanipal of Assyria gathered a great collection of clay tablets—for such were the books of that time—for the great library in his palace at Nineveh, and recent excavations at Nippur in Babylonia have laid bare another library which even in his day would have been considered ancient, for it dates from about 2500 B C The greatest of all ancient libraries was that at Alexandria in Egypt, established by the Ptolemies

Before the hordes of barbarians descended on Rome and sacked it in the 5th century of the



CHAINED BOOKS IN A LIBRARY AT FLORENCE

To prevent theft, many of the old libraries used to chain their books, as you see in this view in the famous Laurentian Library in Florence. The reader sat on the bench, chose a book from the lower shelf of the two-storey lectern, and read it on the sloping desk above. This library was completed in 1571 from designs drawn by Michelangelo for a cardinal of the House of Medici.

Christian era, and destroyed so many books, Imperial Rome had 28 libraries. If Constantine the Great had not changed the seat of government from Rome to Constantinople over a century earlier, and formed a fine library there of manuscripts of the classics and of Christian literature, we should probably not have nearly so many remains of ancient literature as we have now. When the Turks overthrew the government of Constantinople about a thousand years later, the manuscripts in that city were sold and scattered all over Europe.

Many manuscripts were also preserved in monasteries, where the monks would spend laborious days copying them.

None of the ancient libraries or those of the Middle Ages were public libraries. In the medieval monastic and cathedral libraries books were often fastened to the reading desks by chains. The great public libraries of today, to which everyone has access and from which everyone may freely draw books, did not come until comparatively recent times. Public libraries often include not only a lending section, but also a reference library (from which books cannot be removed) and a newspaper and magazine room. The National Central Library exists as a kind of central "pool" for the public libraries.

One of the largest libraries is the Bibliotheque Nationale in Paris, the national library of France. Its vast collection has accumulated since its foundation in the 14th century. The library of the British Museum in London, with its huge circular reading room for students (*see* illustration, page 677), is even larger, and is said to surpass the Bibliotheque Nationale in the value of its contents. Every new book or publication finds a place on its shelves. This is also true amongst other libraries, of the famous Bodleian at Oxford. The new Cambridge University Library, opened in 1934, contains 1,500,000 volumes. The Vatican Library at Rome, founded in the 15th century, is rich in manuscripts and books of great historical value. Other noteworthy collections are the Library of Congress at Washington and the State Library in Leningrad.

Libya, AFRICA. Bounded on three sides by the burning sands of the Sahara Desert, Libya (or Tripoli), the Italian colony in North Africa, receives from the north the moisture of the Mediterranean, which washes its one thousand

FINE NEW ROAD BUILT BY ITALY IN LIBYA

The district of Libya called Tripolitania by the Italians consists of a narrow coastal strip, with a very low shore bordering on the treeless plain called the Jefara The Italians seem to have inherited some of the genius of their Roman ancestors for road-making and this photograph shows a section of the great road that they have built in Tripolitania It runs from near Sollum in Egypt along the whole length of the coast to the frontier of Tunis, a distance of about 1,000 miles

miles of shore line For centuries Libya owed its prosperity to the caravan routes, which converged here from the Sahara Desert The most important of these were the routes to Timbuktu in the south-west, to Lake Chad in the south, and to the Darfur region of the Egyptian Sudan Today the trade in ivory, gold, ostrich feathers, and so on, which formerly flowed over these routes, has mostly been diverted to Egypt on the east and Algeria and Tunis on the west

Italy's Conquest of Libya

After a war with Turkey in 1911–12, Italy gained possession of this great territory and gave it the ancient Greek name of Libya During the World War of 1914–18 it was overrun by Arabs, Turks, and Germans, and after the Turks and Germans gave way the fierce wanderers of the desert continued to defy the Italian government until the armistice of April 1919, preventing Italy from organizing her "empire of sand" A new city of Tripoli has arisen to the east of the old one

Before the dawn of history this region was the seat of a flourishing culture All that is left of this early civilization is a number of great stone monuments—cells cut from the living rock, circles of rough columns, altars, mounds, etc

The earliest rulers of western Libya in historical times seem to have been the Carthaginians, whose capital was situated to the west, on the coast of what is today the French colony of Tunis In the 7th century B C the Greeks founded the city of Cyrene on the north-eastern coast of Libya, and the region called Cyrenaica became one of the great centres of Greek culture Here the sage Aristippus founded the great Cyrenaic school of philosophy, which held that pleasure, tempered by prudence, was the chief goal of life

Cyrenaica passed under Egyptian rule in the 4th century B C, and later became part of Roman Africa It was for a time a flourishing seat of the early Christian Church The name today is retained for the eastern province of Libya, and the village of Grenna stands on the old site of Cyrene Another Roman centre was Leptis Magna, where extensive ruins have been found

In the 5th century A D, Tripolitania and Cyrenaica were conquered by the Vandals, and two centuries later the whole country was overrun by the Arabs In 1510 the city of Tripoli, in the north-west was captured by Ferdinand the Catholic, and from 1530 to 1551 it was occupied by the Knights of St John Then the Turks took possession

Tripoli soon became the stronghold of pirates, and many were the expeditions organized by European nations against these lawless shores

In 1835 Turkey took a firmer grip on the country, but revolts continued until the clash with Italy put an end to the Sultan's rule

Libya may be divided into four geographical zones The first, along the coast, is covered with palm, olive lemon and other fruit trees Here a new strategic highway from the Egyptian frontier was opened by Signor Mussolini in 1937 The second zone formed by the highlands of Gebel and Tarhuna, produces cereals, dates, and figs The Tarhuna district is particularly rich in esparto grass, used in making fine qualities of paper The third zone consists chiefly of oases such as those of Kharga, Baharieh, and Siwa, and is rich in palms The fourth zone consists of the Fezzan and the western Libyan desert In the whole colony there is not a single large river

The richer areas of Libya are inhabited chiefly by Arabs who have driven the descendants of the original Berber tribes into the mountainous districts, where they tend their flocks and herds in comparative independence Along the coast are many Jews, in whose hands is a large part of the country's trade The fierce Tuaregs, the pirates of the desert, control the barren reaches of the Fezzan In the larger seaport towns, Tripoli, Benghazi etc, are colonies of Turks, Maltese and Greeks, the last largely engaged in the sponge fisheries Area, 632,000 square miles, population, about 850,000 Population of city of Tripoli 95,000

Lichens. (Pron li'-kenz) On tree trunks, rocks, old boards, etc, and also on the ground we often see queer patches of variously coloured plant life which we call "lichens" They are of great scientific interest from the fact that they are not single plants but each lichen is formed of a fungus and an alga living together so intimately as to appear like a single plant The lichens furnish one of the best illustrations of *symbiosis* (living together), as the scientists call this intimate relation of two different kinds of organisms The fungus makes the bulk of the body with its interwoven threads, and in the meshes of the threads live the algae The special fungi which take part in this arrangement are almost never found growing separately, but the algae are found growing free

Lichens have a peculiar and effective method of propagation Upon the surface of the body there are commonly seen minute granules which give the body a dusty appearance These granules (called *soredia*) each consist of a few cells of the alga surrounded by threads of the fungus When these soredia are blown off they start new lichen bodies

By many it is thought that the fungus and the alga are mutually helpful, that the fungus, being unable to make food for itself owing to its lack of the green colouring matter, chlorophyll uses the food made by the alga, while, on the other hand, the alga, is protected from drying out by living on the sponge like network of the fungus threads Others, however, maintain that the alga is not benefited by the presence of the fungus, but is held in slavery by it

In any event the combination produces a structure which is able to exist where neither member could live alone As a consequence lichens are able to grow in the most unfavourable places About the last plants one finds in the far north or up on a high mountain are the lichens, and they are about the first plants to be found upon rocks brought above the surface

R M Adam

STRANGE FORM OF TREE-HAUNTING LICHEN

This is one of the most remarkable of all lichens, known popularly as 'old man s beard, and botanically as Usnea barbata As you see, it grows on trees, hanging from the branches in long, hair-like wisps and giving them a weird and grotesque appearance This fine specimen was growing on a rowan tree in Glen Affric, Scotland

A W Dennis

'FAIRY CUPS' MADE OF LICHEN

The name of the lichen you see in the above photograph is Cladonia fimbricata, and it is known in country districts as "pixie cups"; it is easy enough to see how the latter name arose. As shown here it is magnified about three times.

of the ocean or newly exposed through landslides, cliff falls, etc. In such exposed situations the fungus could not live, because it depends upon other organisms; and the alga could not live, because it would be dried out speedily; but the two can live together. In this way lichens play a very important part in the first stages of soil formation on bare rocks.

Certain kinds of lichens, such as those called "Iceland moss" (*Cetraria islandica*) and "reindeer moss" (*Cladonia rangiferina*) are used as food by reindeer and even by Man. Other kinds produce dyes, drugs, etc. One of the finest species occurring in Britain is the "old man's beard," *Usnea barbata*, which makes long, grey, hair-like festoons on the branches of trees. Another is *Cladonia*, species of which make the familiar "pixie cups" of heathy land. (*See* Algae; Fungi.)

Lichfield. The city of Lichfield, though it is chiefly a market-town and has no industry but brewing, is yet of great interest on account of its 13th–14th century cathedral and its associations with Dr. Johnson.

The cathedral (*see* picture in page 874) is not large, but it is very beautiful, being built of the local red sandstone. The west front is elaborately carved, and instead of the three towers which figure on so many English cathedrals it has three graceful spires. The interior is imposing and dignified, and there is some very lovely stained glass. Johnson was born in a room in his father's bookshop at the corner of Market Street, and the house is now a Johnson museum. (*See* page 2358.) Next door is the Three Crowns Inn, where Johnson and Boswell stayed during their visit to Lichfield in 1776. The Johnson Society holds its annual meeting in the inn.

David Garrick was born at Lichfield, but his birthplace no longer stands. Both he and Johnson are buried in Westminster Abbey, but there are memorial busts to them in the cathedral. There are statues of Johnson and Boswell in the market-place. Notable buildings are the bishop's palace and the theological college. The population is about 8,500.

Liechtenstein. Next to Monaco the smallest independent State in Europe, the Principality of Liechtenstein lies between Switzerland, to which it is closely allied, and Austria. It occupies a narrow valley 15 miles long between the Rhine and the province of Vorarlberg, with an area of 65 square miles. The capital and seat of government is Vaduz, which contains 1,700 of the total population of 10,000. Agriculture, cotton weaving and spinning, and leather and pottery manufacture are carried on.

It was by a diploma granted by the Emperor Charles VI in 1719 that the principality was constituted, with a hereditary monarch whose line dates back to the 12th century. The currency and the postal system are Swiss, but Liechtenstein issues its own stamps.

Liége, (Pron. lē-āzh'), BELGIUM. In the wars of Europe from medieval times to the World War of 1914, few towns have figured more prominently and frequently than this Belgian city. Even in the Middle Ages Liege was one of the arsenals of Europe. Today the rich coal mines in the valley of the Meuse, on which Liege is situated, make it the chief manufacturing centre of Belgium.

The smoke of a thousand chimneys hangs over the roofs of the "Belgian Birmingham," as it is called, which, like its English namesake, is famous for the manufacture of guns and firearms of every kind, together with steam-engines, machinery, hardware, and textiles.

The history of Liége goes back to St Monulph, who travelled through the beautiful Meuse valley in the 6th century The chapel which he built was the beginning of the present city, and also of its rule by the bishop, which lasted until 1795 For many centuries the prince bishops of Liege sat in the diets of the Holy Roman Empire, and the city was famous as a centre of religion and learning long before its mineral wealth was suspected Today Liege is the centre of the Walloon culture, which is akin to the French

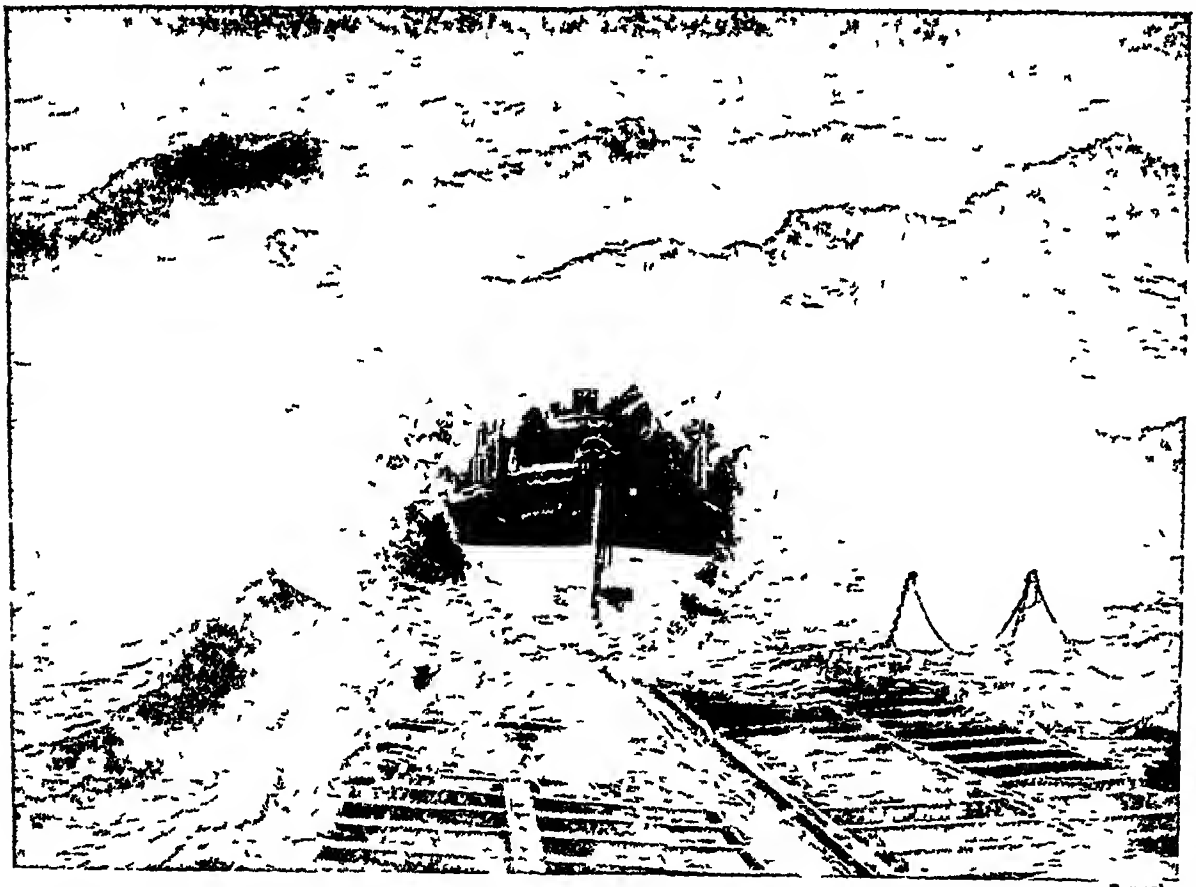
At Liege was fought the first great battle of the World War (Aug 4 to 9, 1914) The resistance of its girdle of strong forts enabled the French and British to prepare the resistance which stopped the Germans on the Marne The population today is about 161,000

Lifeboat. When storms rage round our coasts and S O S messages pass through the ether, we think of the brave lifeboatmen battling against the elements—in the darkness of night, maybe, and at the risk of their lives—to succour those in danger For the British are a seafaring race, familiar with all the terrors and perils of the sea, and rightly regard the shipwrecked mariner, clinging to the doomed vessel that is being dashed to pieces on the rocks, as deserving of the utmost efforts to effect his rescue

Just as the British mercantile marine is second to none in the world, and the British sailor unrivalled for pluck and enterprise and nautical skill, so it is fitting that the British lifeboat service is acknowledged to be without equal

The lifeboat which is now such a familiar institution to all who live on our coasts, or who take their holidays at the seaside, is a comparatively modern invention Lukin patented the first lifeboat in 1785 An even more successful lifeboat inventor was Henry Greathead, who constructed a boat and patented it in 1789 Cork was largely used in Greathead's lifeboats, which, with slight alterations, remained the accepted standards for over sixty years and were instrumental in saving thousands of lives from wrecks

Great improvements have been made since his day, however, and today our coast lifeboats are so reliable that, if necessity arises, even the worst of storms cannot prevent them from being launched In recent years motor lifeboats have been adopted, and a large number of these are now in service When the new programme is



Topical

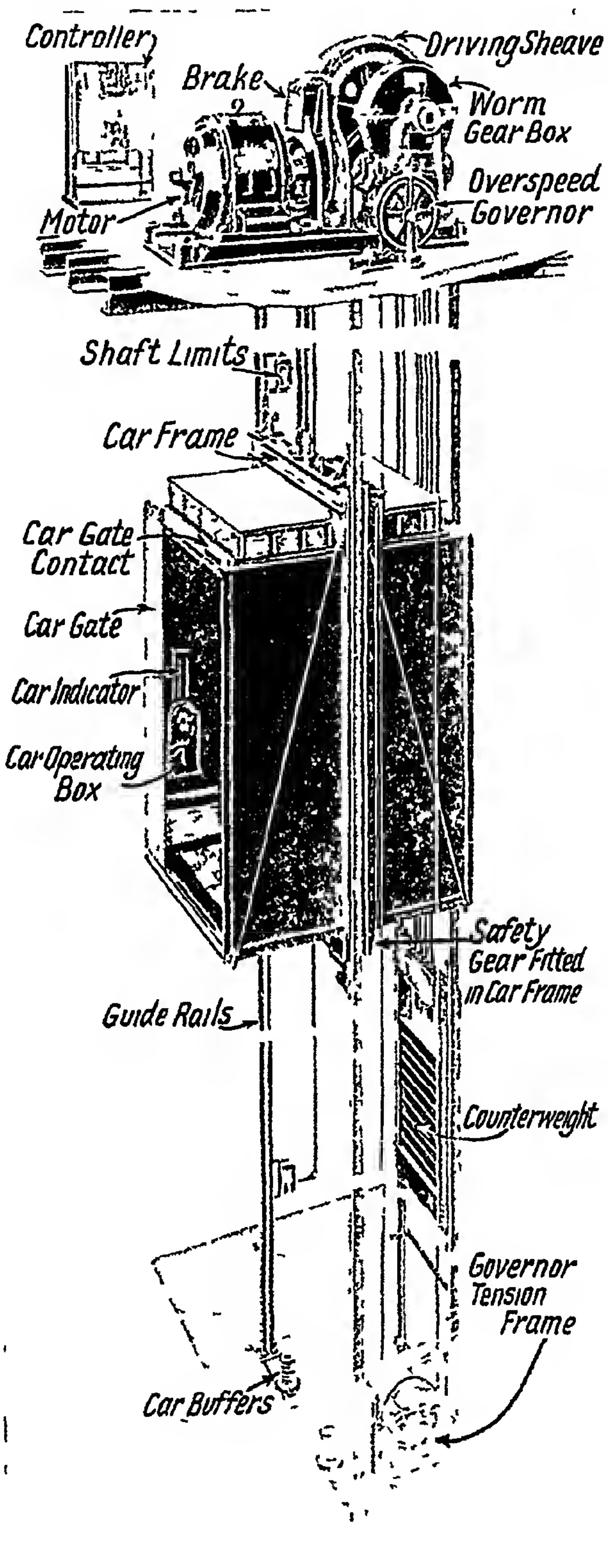
THE LIFEBOAT PUTS OUT IN A STORMY SEA

The launch of the lifeboat is always a thrilling spectacle Sometimes it has to be done by men and women dragging the boat on its carriage down the beach and wading deep into the water, but at the most modern lifeboat stations a slipway is used down which the lifeboat glides into deep water This photograph shows the launch of the Cromer lifeboat down such a slipway The boat itself is of the most modern type propelled by mechanical power instead of by oars

concluded practically every lifeboat round the British Isles will be of the latest motor-driven type, costing from £3,000 to £9,000 apiece. The lifeboat crew usually consists of fishermen belonging to the place where the lifeboat is stationed, and the heroic rescues made by these men constitute some of the most thrilling chapters in the story of the sea.

In the British Isles the lifeboat service is maintained by the Royal National Lifeboat Institution (R.N.L.I.), which has 168 lifeboats stationed around our coasts. The service has saved over 60,000 lives since its foundation in 1824, and for its efficient upkeep spends over £275,000 a year. But, if this seems a lot of money to spend, let us look for a moment at the cost in human life. To rescue, under no other obligation than that great humanity which unites us, more than 60,000 lives, the gallant lifeboatmen have lost nearly 300 members.

One tragedy may be recalled—that at Rye Harbour on November 15, 1928. At 6.45 a.m. that day the Rye lifeboat, a rowing and sailing craft, with a crew of seventeen, went out to the rescue of the Latvian vessel Alice in the teeth of a terrible full gale from the south-west, with a very heavy sea running, leaden skies, and blinding, heavy rain squalls. Five minutes after she had left, smothered in the heavy seas of an in-coming tide, a message arrived at the station to say that the crew of the Alice had been rescued by a steamer. But the recall gun, fired three times, was unheard by the lifeboat, then battling with the tempest. Her mission all in vain, she was seen returning, the wind had increased and the rain squalls became heavier. Then, just as she seemed to make the harbour mouth on the crest of a great on-coming sea she capsized. Every single member of the crew of seventeen was washed ashore—dead, not one survivor remained to tell the tale of their last effort.



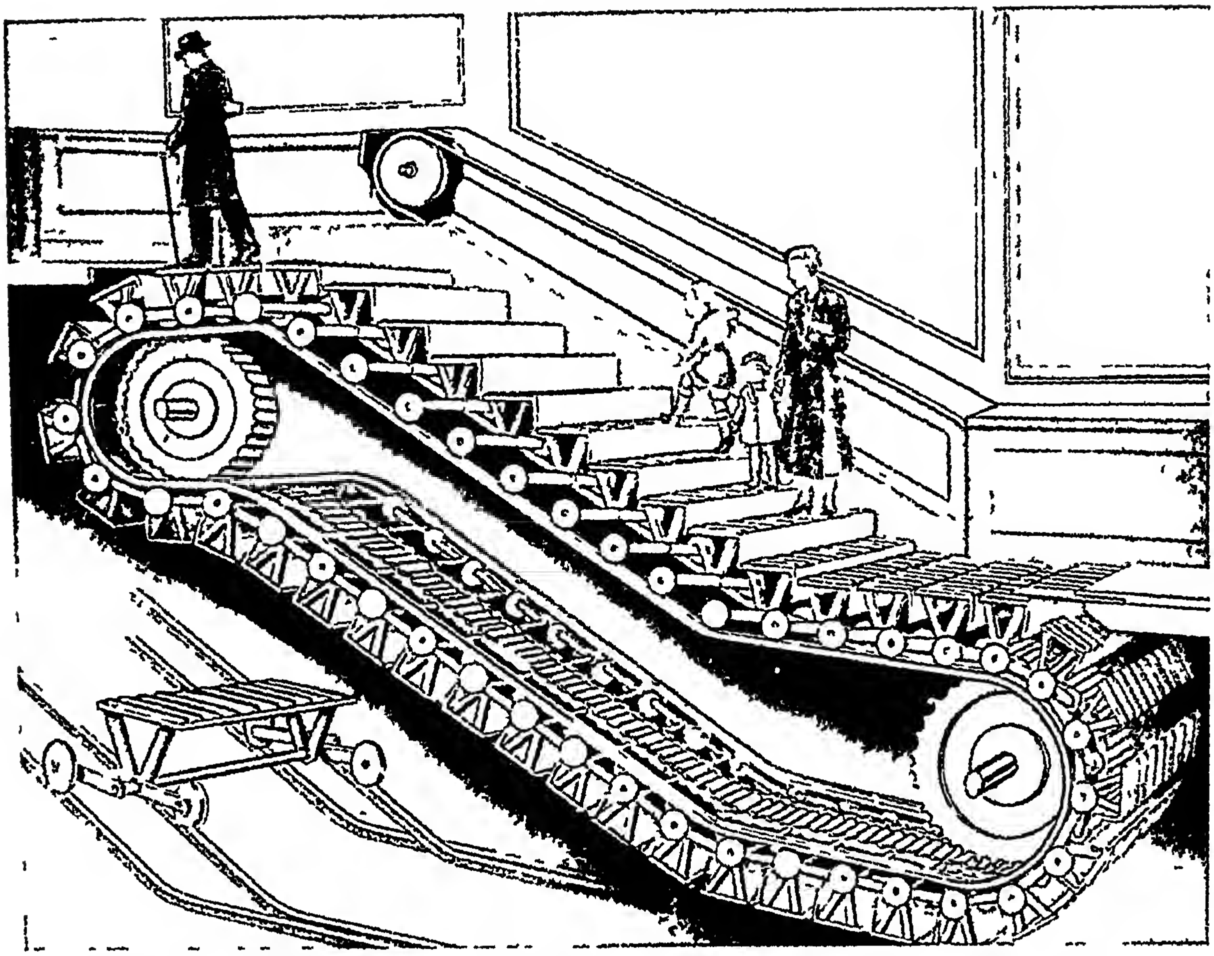
ELECTRIC PASSENGER LIFT

This illustration shows the working of an electric lift. The weight of the car, which runs on steel guide-rails, is balanced by a counter-weight, here seen just below the car. The electric motor above has therefore only to exert the power necessary to lift the additional weight of the passengers.

Courtesy of Waygood Otis Ltd

Lifts and Escalators. The passenger lift, or "elevator," as Americans call it, enables us to pass from the ground floor to the top floor of a high building in a few seconds, whereas by walking up the stairs nearly as many minutes might be required. The construction of a lift is not very complicated. Strong cables, with the car at one end and a counterweight at the other, pass over two pulleys or "sheaves" at the top of the shaft—first over the driving sheave, then over the second or "idler" sheave, and back over the first, making a complete loop. Wound like this, the cables cannot slip, for the greater the weight the tighter they pull. The counterweight of massive iron bars is made to weigh about as much as the car with an average load, so that the electric motor has only to lift the excess load.

Attached to the side of the lift (*see* illustration on left) is a further endless cable running over pulleys at the top and bottom of the shaft and acting as an overspeed governor. The motor which turns the driving sheave in either direction is operated by a mechanism in the car. A



THE ESCALATOR MOST MODERN TYPE OF PASSENGER LIFT EXPLAINED

This diagram shows how an escalator works It consists of a series of steps, similar to that shown enlarged on the left, having two wheels on each side The pairs of wheels are out of line with each other, and run on separate pairs of rails All these steps are linked together and are moved by an endless chain in the centre working round two large cog-wheels At the lower end of the escalator the rails slant upward and are further apart, the wheels adjusting themselves and each tread rising gradually When the treads pass from the inclined part to the short horizontal length at the top they become flat

brake, consisting of leather-faced shoes acting on a brake pulley, holds the car at any point where it is stopped

What would happen if the car should fall? It is not likely that it will, for six stout wire hoisting cables are generally used, each of them strong enough to hold up the weight of the car But if they should all give way, there are powerful steel jaws on the bottom of each car, which reach out and grasp the rails on which the car rides, if the speed reaches a certain high rate The brakes also set automatically when the power is shut off In addition, cushion buffers are placed at the bottom of the shaft

Some small hotels and business houses have automatic lifts which can be operated by the passenger Each landing has a push-button which brings the car to that floor unless it is already in use In the car is a series of buttons and when the button corresponding to any given floor is pressed the lift travels to that floor It is impossible to open the door unless the car has come to a full stop, and the car cannot be started while the door is open

In the most familiar type of hydraulic lift the car rests on a hollow pipe, which fits closely into a strong iron cylinder sunk into the ground as deep as the building is high Two openings in the pipe let the water out and in When water is forced into the cylinder by a powerful machine, the plunger, carrying the car and the passengers, is forced upward The water pressure is cut off when the car has gone as high as desired When the operator wishes to descend, the outlet pipe is opened and the car sinks as the water escapes from the cylinder A counterweight is used in these lifts also

The moving staircase, or escalator, is used chiefly in Tube railway stations and also in a few large department stores, where it provides a more economical and convenient means of transport than a lift of the same first cost It consists of an endless chain belt, set at about the same angle as a flight of stairs Some are constructed with wooden slats as a footing while treads and risers give others the appearance of an ordinary flight of stairs in motion A hand-rail moves along at the same speed

A WONDERLAND *in a* FLASH *of* LIGHT

Like heat, light has mystified Man from the time when he first began to notice his surroundings, and even today scientists are not agreed as to what it is. However, its "laws" are well established

Light. The speediest traveller in the universe is a beam of light. In the double tick of a clock it can go round the earth more than seven times. And, compared with most other moving agents about us, light does travel "instantly."

Sound travels through the air at about 1,100 feet a second, more than ten times the speed of the fastest railway train, and yet sound seems to stand still when light goes by.

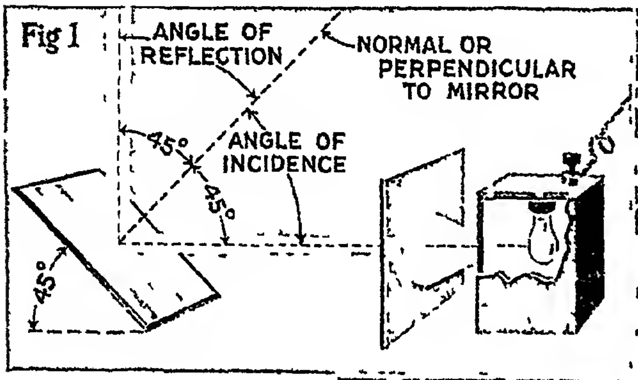
But light does not *really* come instantly. The first person to show that light actually takes time to go across space was a Danish astronomer, Ole Roemer. This important fact he elicited while studying "inconsistencies" in the periodic motions of the satellites of the planet Jupiter.

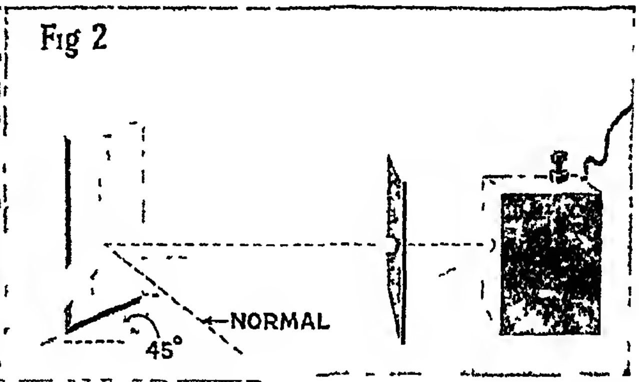
That was in 1676, but it was not until 1849 that a method was found to measure the speed of light. This was done in Paris by a French professor, Armand Fizeau. He chose two high towers or stations a little more than five miles apart. At the first he had a bright light, and at the second he placed a mirror, which reflected the beam of light directly back to the first station.

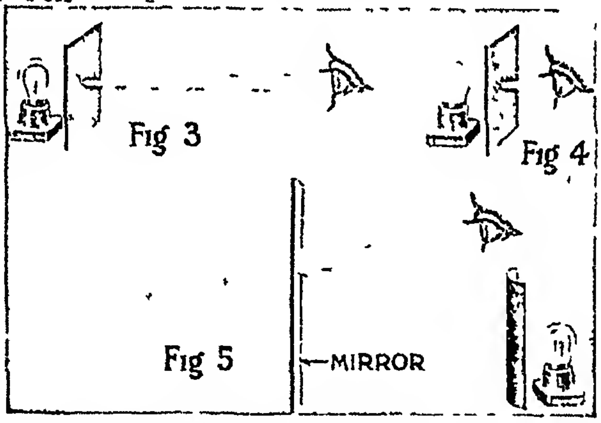
Then he put at the first station a revolving toothed wheel, a sort of cog wheel, so arranged that the beam of light went out through the openings between two teeth. It was reflected back through the same opening, when the wheel was at rest. But when the wheel was revolved rapidly enough, the light that came back found that a tooth of the wheel had moved into the place of the opening, thus no light could be seen reflected from the second station.

The time which the light took to travel from the first station to the second, and back again to the first station, was thus the time that it took a tooth of the wheel to move to the place of the opening. By doubling the speed of the wheel, Fizeau could again see the reflected light, because a second opening had now moved into the line of sight. From a speedometer he could get the number of revolutions, and thus calculate the time that it took the light to travel between the stations and back.

The distances in the heavens are so great that even to get from the sun, at 186,000 miles per second, light needs about eight minutes. To come from the nearest fixed

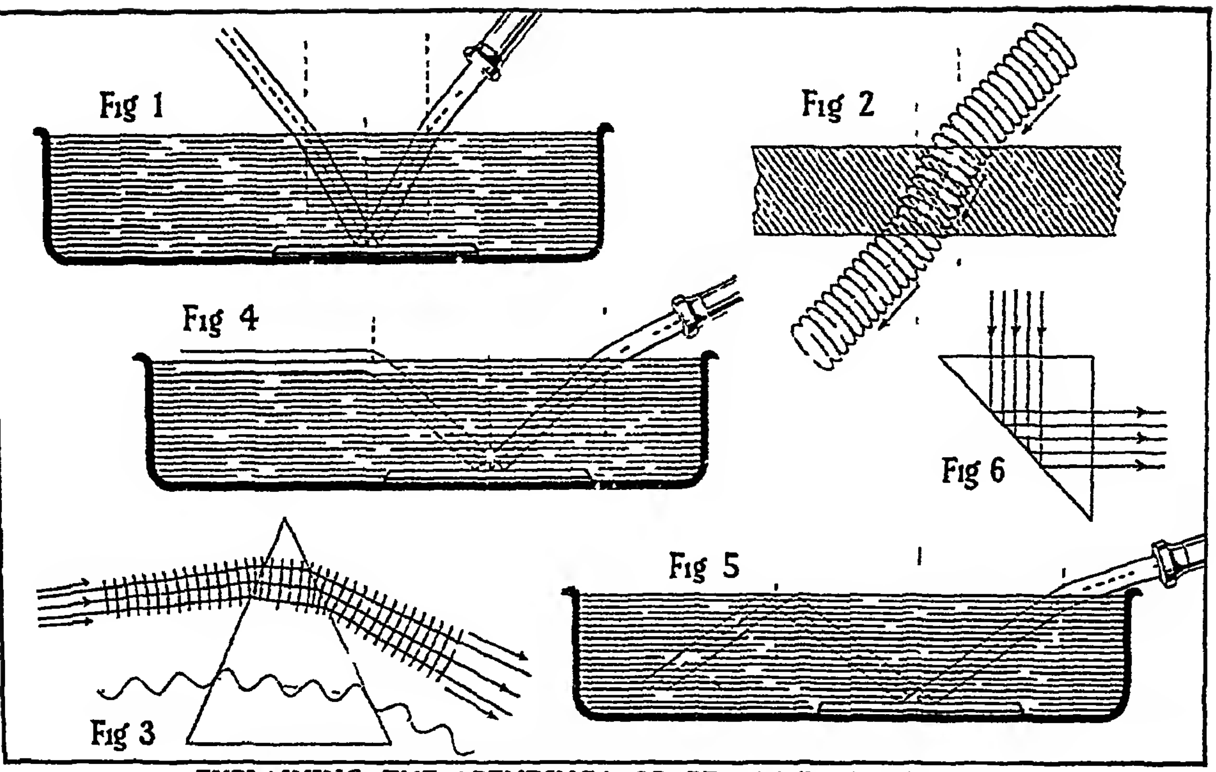






EXPERIMENTS IN REFLECTION

After setting up, in a suitable dark place, the apparatus shown in Fig 1, notice the relative positions of the beam from the box to the mirror (the incident, or striking, beam) and of the reflected beam. Now imagine a perpendicular (shown by a dotted line and called a normal) rising from the mirror where the incident beam strikes. This line, you will see, always lies midway between the two beams, so that the angle it makes with the incident ray is equal to the angle it makes with the reflected beam. This gives us the Law of Reflection stated in the text. Fig 2 shows the same experiment for horizontal reflection. Figs 3 and 4 show how the eye can judge distance from the divergence of light rays. When the eye is distant from the pinhole of the screen, as in Fig 3, only rays having a slight angle can enter the pupil of the eye. When the eye is nearer, as in Fig 4, the angle can be greater—and the eye always sees the point as being at the apex of the angle. This explains what one "sees" in mirrors, as in Fig 5. Here light is actually coming from the pinhole in a screen some distance in front of the mirror, but as the diverging rays enter the eye they seem to be coming from a point as far behind the mirror as the light is in front. Applying this to every point of the light in turn shows why the eye "sees" an inverted image behind the mirror, as shown. Such an image is called a virtual image, because it exists only "in your mind's eye." If, however, you placed a screen where you stood and looked at it you could see the reflected image. It is then a real image, because it can be thrown on a screen.



EXPLAINING THE 'BENDING' OR REFRACTION OF LIGHT

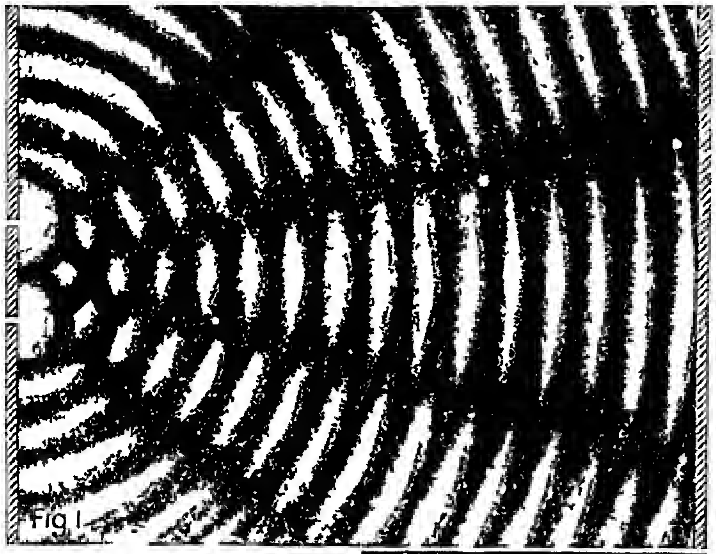
Refraction can be studied easily with a shallow water tank, such as a square-sided aquarium, a mirror, and some means for throwing a straight beam of light First arrange as shown in Fig 1, darken the room, and turn on the beam Imagine a normal, or perpendicular to the refracting surface (as the boundary between the water and air is called), and note the angles made with it by the beam before and after entering the water—also with the second normal where the beam emerges from the water after being reflected from the mirror You will notice that the following law holds true when the light passes from a lighter to a denser medium (as in passing from air to glass) it is bent toward this normal, when it passes from a denser to a lighter medium (as in passing from glass to air) it bends away from the normal This is the Law of Refraction and its action is explained in Fig 2 Here imagine our light ray to consist of a succession of disks and suppose that these disks must be forced 'broadside on" through any medium traversed by the ray Remember now that light travels more slowly in denser mediums than in lighter ones Obviously, then when the ray strikes slantwise on the water the portion striking first will not travel as fast as the portion still in the air This second portion then will turn around the first, as round a pivot until it, too, has sunk into the glass and the wheeling each disk undergoes on entering the glass causes the ray to travel in a new direction through the glass Each disk in turn undergoes this deflection When the ray emerges from the other side of the plate, and one portion of each imaginary disk begins to travel faster than the portion remaining in the glass, the reverse action takes place. The ratio of the two angles marked is called the refractive index between the two materials used (being 4 to 3 for light passing from air to water) Fig 3 shows this action and shows why either the "corpuscular" or "wave theory of light can explain the action The straight lines represent "rays of corpuscles, while the curved ones are "waves" Note that the "rays' are always radii of the "waves" Waves may also be represented "sidewise" as shown Fig 4 shows the "critical angle," produced when the bending on emerging is such that the emerging ray just grazes along the water If an even greater angle is used, as in Fig 5, the beam is "totally reflected" back into the water Fig 6 shows how a glass prism with a critical angle of about 42 degrees can act as a reflector of light rays in air

stars, it takes more than four years, and many stars are so distant that the light we saw last night started hundreds of years ago It is now customary for astronomers to refer to stars as being so many "light-years" away

How are we to explain light? Let us go back for an idea to a sport of our childhood The boy throws a stone into a smooth pond or pool to watch the waves it makes on the surface of the water These waves go out in circles, and these circles travel outward until they are deflected or reach the shore In Holland about 250 years ago there was a great mathematician and scientist who found in water waves a suggestion of what light is This great man was Christiaan Huygens, who in 1690 published a book in which the wave theory of light is expounded

Of course, light cannot be a wave motion in a heavy substance like water Huygens said that there must be a substance which is far thinner than the lightest gas, is without weight, and spreads through all space This substance we call the ether The only way we can know of its existence is by the waves in it

A beautiful instrument has been invented which enables us to measure the length of light waves, the "interferometer" In this instrument two beams of light, travelling different lengths of path, can be brought together so as to produce darkness, that is, so as to annul each other Now we cannot imagine adding together two material things and getting nothing But we can think of adding together two motions, one *up* and the other *down* and get *no* motion Thus, if two waves of light are brought together by the interferometer so that the crest of one wave and the hollow of the other wave fall together, they interfere with each other and produce darkness This is called the "interference of light"



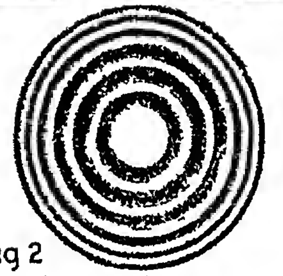
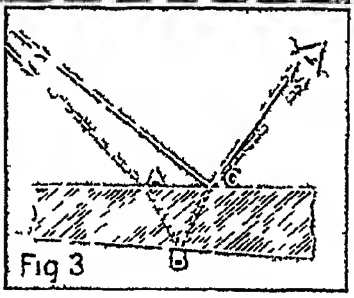


Fig 2



'INTERFERENCE' AND ITS EFFECTS

The top picture illustrates Young's experiment with a pool of mercury, which led scientists to believe in the wave theory of light The dark lines represent the "troughs" of light waves radiating from the two pinholes at the left, the crests being between Notice that only along three lines in the picture do "troughs" fall on "troughs" and "crests" on "crests"—so that light travels outward along these lines and can strike a screen In between, the waves "interfere" with each other and no light passes outward Hence alternate bands of light and darkness will strike a screen, as Young found Fig 2 shows "ring interference," called "Newton's Rings" from the experiment Newton made but did not explain, obtained similarly by laying a convex lens on plane glass Fig 3 shows the cause of iridescence, or shimmering colour, as in an opal, films of oil, and certain bird feathers If light strikes a thin, wedge-shaped film, certain rays, as at A, will strike in, be reflected from the bottom of the film, as at B, and emerge with further refraction, as at C All rays reflecting directly from C, except those of one colour, will interfere with the other ray—so only that colour is seen As the shape of the wedge, or the observer's position, changes, so does the colour which "gets through" Thus the beautiful shimmering play of colour is created

With the aid of this instrument the incredibly small distance between crest and hollow of a light wave can be measured with the greatest accuracy For a certain shade of yellow light, called "sodium light," the wave length, that is, the distance from crest to crest, is 579 millionths of a millimetre, or about one forty-five thousandth of an inch In other words, along a beam of this particular yellow light there are 45,000 waves to an inch

Each colour has a different wave length from any other colour Thus the wave length of red light is about one-third longer than that of yellow light, and the wave length of violet light is about one-quarter shorter than that of yellow light

The short invisible light waves are called *ultra-violet* rays, and the shortest of all invisible rays are the X-rays The ultra-violet rays are instantaneously destructive to bacteria and so are often used to purify water The long invisible light rays are called *infra-red* rays or radiant heat rays All these waves have the same velocity, that is, they travel at the same rate, about 186,000 miles per second

How do we get light? How are these little waves in the ether started? Our chief source of light is from hot bodies The greatest source is the sun, which is hotter than anything on the earth, hotter even than the electric arc The stars, except the planets, are also hot suns But not all sources of light are hot The dazzling little fireflies that are seen in thousands on a summer evening in many parts of Europe have little if any heat, and yet the firefly gives off considerable light There are also so-called phosphorescent substances, such as are used in luminous paints, which glow in the dark without measurable quantities of heat

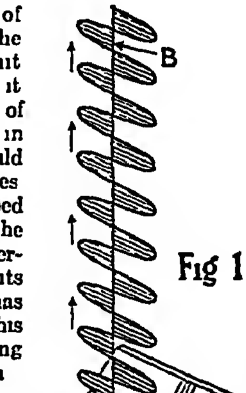
When light strikes against an object it is reflected in a new direction, just as a ball bounces from a wall It is only by the light rays reflected from their surfaces that we are able to see objects From these reflected rays we learn the size, shape, and colour of an object The direction reflected light takes is determined from the following law "The angle of incidence equals the angle of reflection" This means that a ray of light will depart from a reflecting surface at the same angle at which it arrived

Some objects, like glass, offer very little hindrance to the light rays and let them pass right through Such objects are called transparent The light waves travel almost as easily (though slower) through glass or ice as through air, and that is how we are able to see objects on the other side of them In travelling through such objects, the path of the light ray is slightly bent This bending of the ray of light in passing from one medium to another is called *refraction*

When a straight stick is thrust into water it appears to be bent at the surface because the light reflected from the stick is bent or refracted in coming from the water to the air Although light rays are refracted in the same way by window glass, for instance, we do not usually notice it, because they are refracted in opposite directions at each surface of the glass, and the second refraction cancels the first, so to speak In prisms and lenses, however, where the surfaces of the glass are not parallel, the refraction of the light rays is the important

HOW MIRRORS CAN 'ANNIHILATE' LIGHT

Fig 1 Here we see a conventional 'wave diagram, showing two ' lines at right angles to each other which is a good representation of a three dimensional wave The rules of mechanics tell us that all the forces in a wave can be resolved into these two To understand how such a wave is polarized" by mirrors, remember that space is supposed to be capable of transmitting *transverse* vibrations—that is, waves which as shown by the arrows, move crosswise to the direction the pulse is travelling It is supposed however, not to transmit *longitudinal* vibrations —that is, those moving to and fro along the direction of the motion Now see how this wave strikes the mirror and is reflected upward along the line A—B, the centre of impact being at A Remember here the principle that space is unable to transmit longitudinal vibrations, and see how it affects the reflection at A If the "angle of incidence" is 57° (for an unsilvered mirror in air) the movements of the vertical wave would have to be reflected as longitudinal pulses Since this is impossible, they are absorbed by the mirror along the line A–C but the horizontally vibrating wave is reflected perfectly as shown Note, however, that all its vibrations are in one plane That is it has been 'plane polarized" To the eye, this merely weakens the light—but by comparing Figs 2 and 3 we shall see the polarization



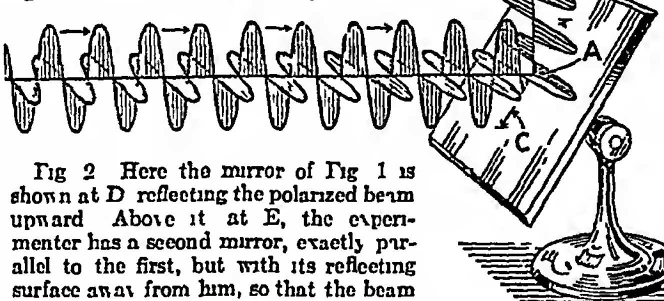


Fig 1

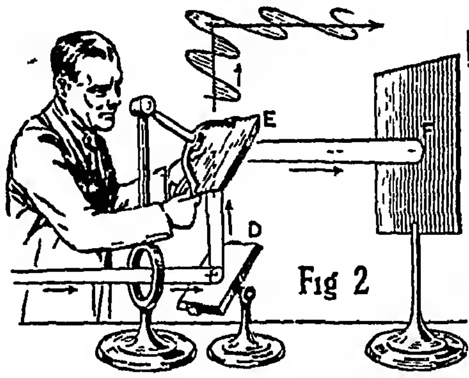


Fig 2

Fig 2 Here the mirror of Fig 1 is shown at D reflecting the polarized beam upward Above it at E, the experimenter has a second mirror, exactly parallel to the first, but with its reflecting surface away from him, so that the beam from D is reflected horizontally to the right since the vibrations in the beam come transversely and can be reflected transversely, as shown in the little sketch to strike the screen at F

Fig 3 Here we see the phenomenon which by contrast with the negative result in Fig 2 demonstrates that the light has been polarized The observer has turned the upper mirror horizontally through 90 degrees to the position shown Now as the little sketch shows the vibrations of the polarized beam are in the same situation as were the vertical vibrations at A in Fig 1 In order to be reflected outward along the line G–H as the ordinary laws of reflection require they would have to travel as longitudinal vibrations—which our assumptions tell us cannot be done The facts bear this out for no light is reflected—that is, this arrangement of mirrors able in any other position to reflect light perfectly well in this position *annihilates the beam of light* the vibrations presumably being absorbed along the line G–J of the upper mirror This result which would have marked any man as a great magician in other days is only one of many polarization effects science can obtain

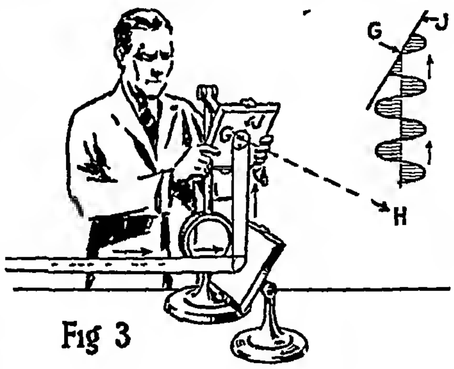


Fig 3

function for which they are employed, as in the microscope, telescope, and prism spectroscope

There is another interesting property of light called polarization Certain transparent crystalline substances, *e g* , tourmaline, cut off some of the light vibrations, and light passing through such crystals is said to be *polarized* If you could look at the end of a greatly magnified ray of light, you would see the vibrations going up and down, crosswise, and in every possible plane, like the cracks in the cross-section of a log Now, when this ray of light passes through a thin slice of tourmaline, all the vibrations are shut out except those in the direction of its axis, just as though the ray had come through a narrow door which shut out all the crosswise vibrations Again, it is found that when the polarized rays are passed through certain substances they are bent to the right, and in others to the left Thus, some sugars deflect the plane of polarized light to the right and are known as dextro-rotatory, while others turn it to the left and are called laevo-rotatory sugars In chemical analyses this distinction is important as showing the arrangements of atoms within the molecule of sugars having identical formulae but different properties These phenomena are used for many scientific purposes One of the most important is in the examination of very thin sections of rocks through a microscope so arranged as to give polarized light The various minerals in the section are then shown up in their distinctive formations

If light is a wave in a still ether and our earth spins in the ether from west to east, light travelling with the earth should seem slower than light travelling east to west Failure to observe this led to the theory of Relativity

LANTERNS *that* LEAD SHIPS *to* SAFETY

There has always seemed something romantic about lighthouses, though the life of a lighthouse-keeper is a hard and dangerous one. How he keeps his beacon alight in all weathers is described in this article.

Lighthouses AND LIGHTSHIPS In the days when Columbus and other bold mariners set sail on uncharted seas, they were in constant peril even in European waters from shoals and submerged rocks And, when they neared strange lands, they found no warning beacons or friendly signs to mark dangerous shores or to guide their barks through difficult and winding channels into safe harbours Today the ocean lanes are dotted with more than 13,000 lighthouses and lightships, whose powerful beacons guide the seaman as plainly as a blazed trail guides the pioneer, and every harbour is marked by buoys and other signals as plainly as a city street

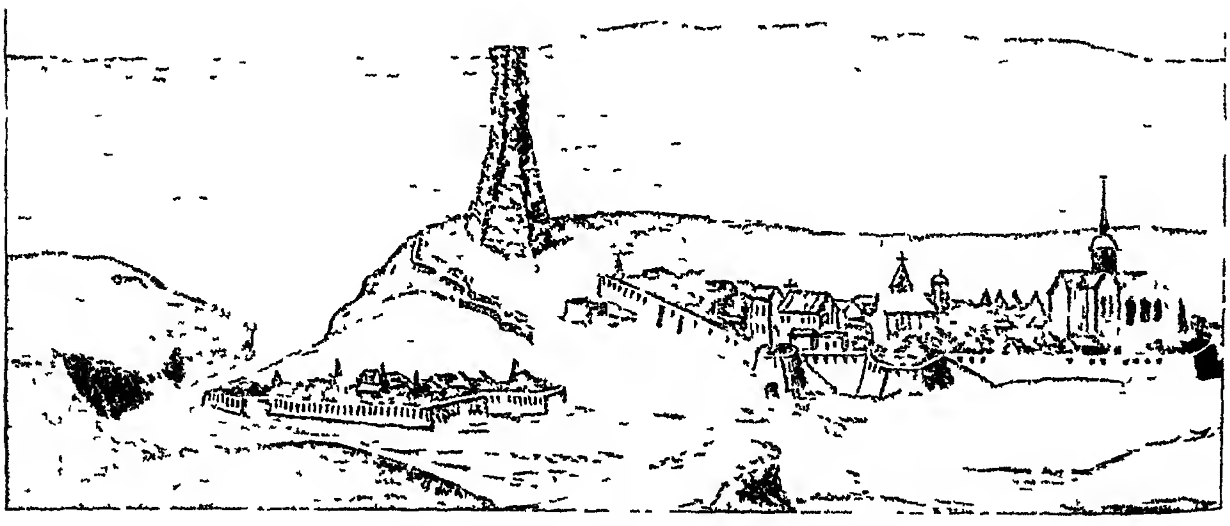
La Corbière, Jersey

If it could only speak, the lighthouse on its perilous reef, "a dim gigantic shape, holding its lantern o'er the restless surge," could tell many a thrilling tale of all that it has seen Brave and skilful men have laid its foundations, sometimes working on half-submerged ledges buffeted by the waves, sometimes in caissons boring deep through the sand to the rock below It often takes a whole year just to drill a few holes in the rock or to lay a single stone!

The lighthouse has also seen many patient and plucky keepers who have faced countless dangers of storms, of shifting sands, of oil explosions, and of the ever-hungry sea that tries to undermine the tower, and in the face of these dangers they have performed many heroic deeds We have all heard of Grace Darling, (*q v*), the English lighthouse-keeper's daughter, and how she and her father rowed out to save the survivors of the Forfarshire

Until recent years lighthouses were huge piles of masonry of a thickness to withstand the buffeting of wave and wind Today the typical lighthouse is a tapering cylindrical steel tower from 100 to 400 feet high, bolted into the solid rock of a reef or into a masonry foundation A winding staircase within leads up to the gigantic lantern at the top, whose blinding shaft of light may be seen from the deck of a vessel twenty or more miles away In the rather cramped quarters provided, the three keepers may live for months on end

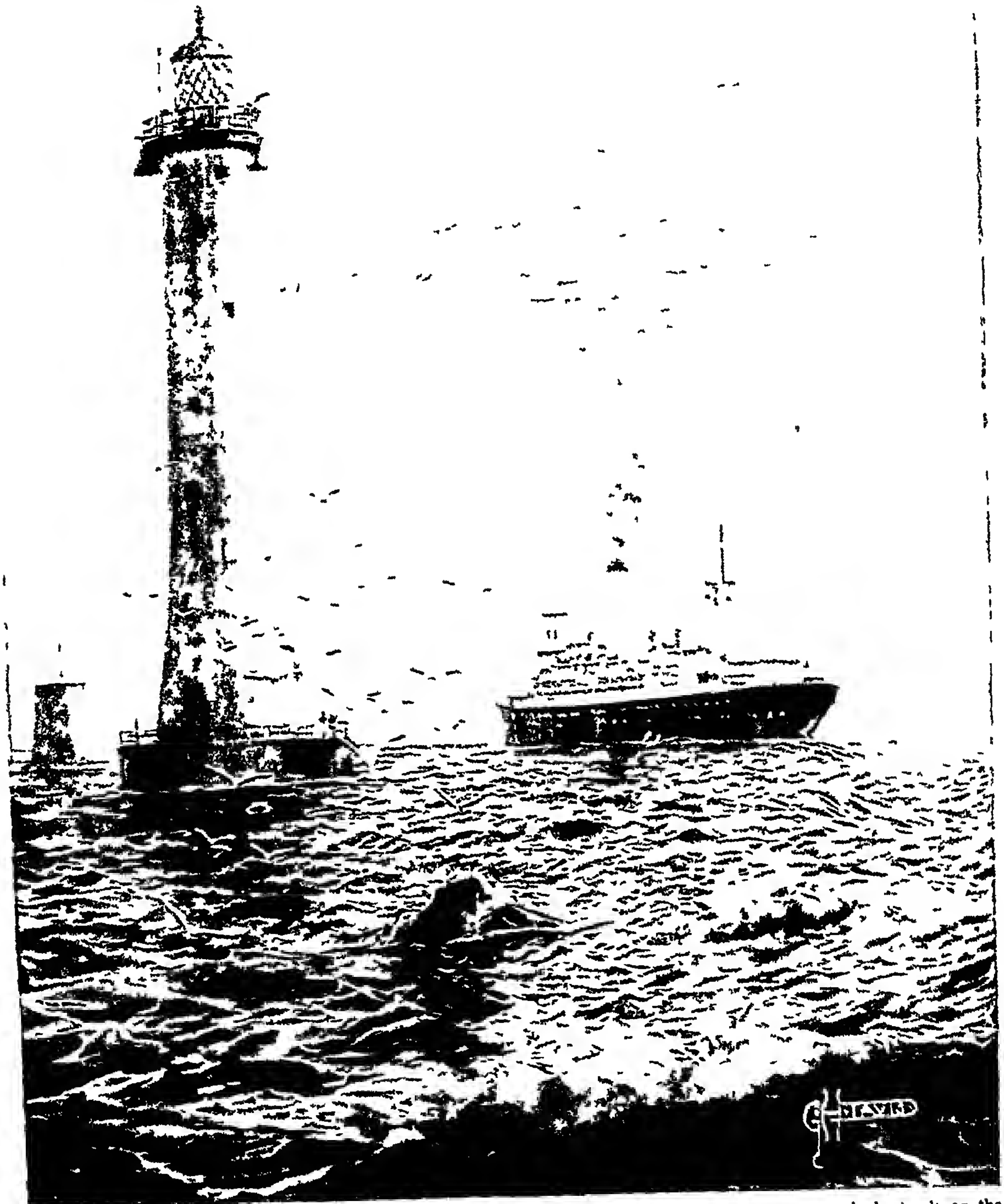
The lantern consists of from two to eight lenses held by a light metallic frame, with reflectors and prisms which concentrate the light and throw it out It is usually set in a revolving carriage moved by clockwork, so as to show a regular series of flashes by which one lighthouse may be distinguished from another



AN ANCIENT GUIDE FOR ROMAN SHIPS

Crude as it appears to us, this lighthouse did its work faithfully at Boulogne in France for 1,400 years after it was built by the Romans The powerful flashing lights we use were unknown in those days, of course, and the warning light was furnished by bonfires, but to have even this flickering signal was better than groping blindly through a stormy night The picture is taken from an old print of the famous structure

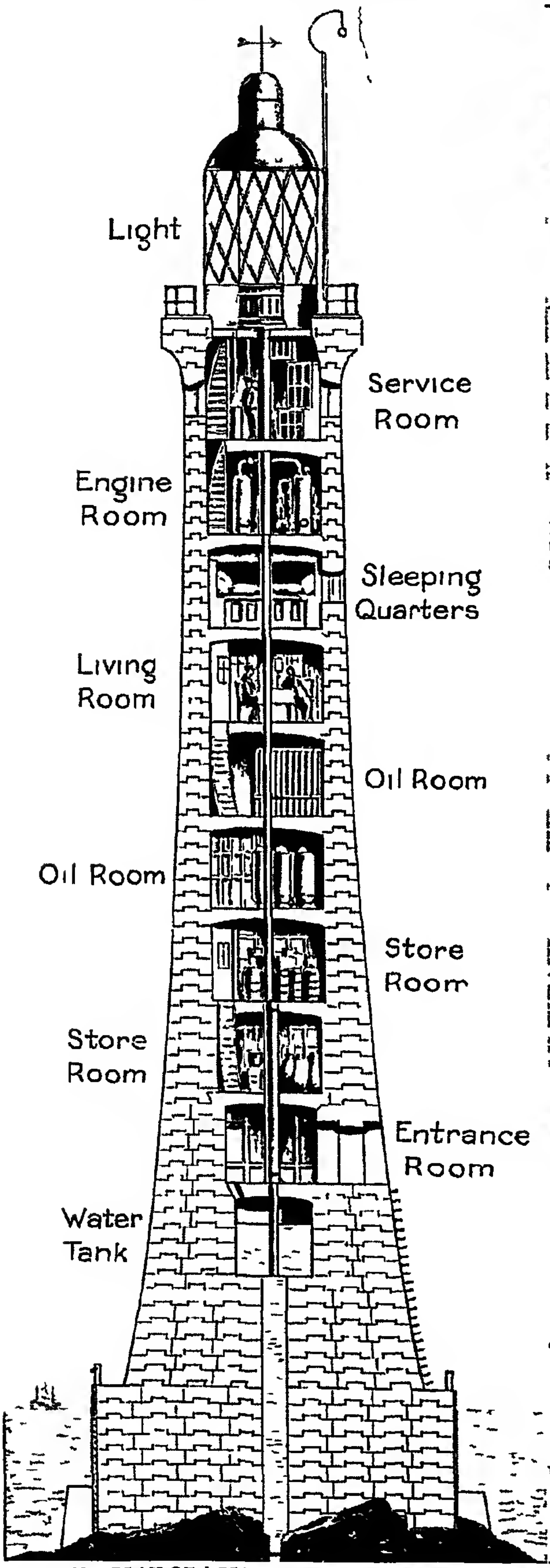
THE GIANT SENTINEL OF THE ENGLISH CHANNEL



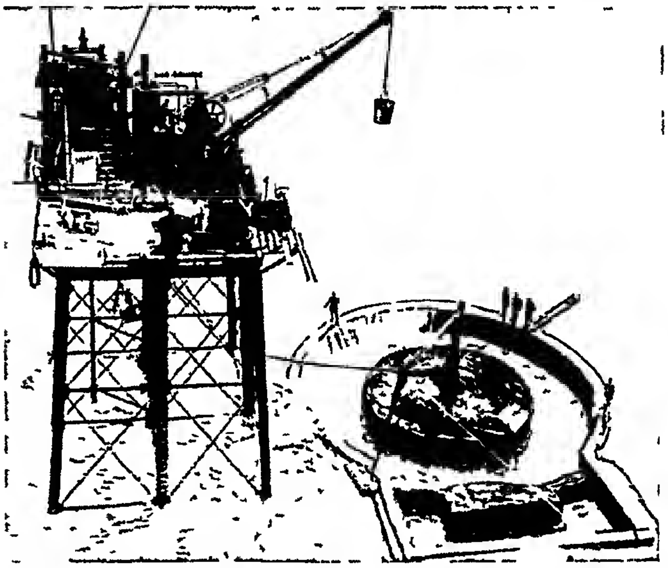
Wonderful is the fascination of the lighthouse! Here you see the majestic Eddystone Lighthouse, which stands on the dangerous Eddystone Rocks 14 miles south-west of Plymouth There have been four Eddystone lighthouses The first, a wooden building, was destroyed by a hurricane in 1703, and the second was burned down in 1755 The third, a granite structure, 95 feet high was dismantled in 1877, the upper sections being transferred to Plymouth Hoe The present tower, completed by Sir James Douglass in 1882 stands 168 feet above low water, and the lantern shows a group-flashing light of two flashes every thirty seconds, which can be seen for nearly 18 miles The base of the third lighthouse is seen to the left

Painted specially for this work by G H DAVIS

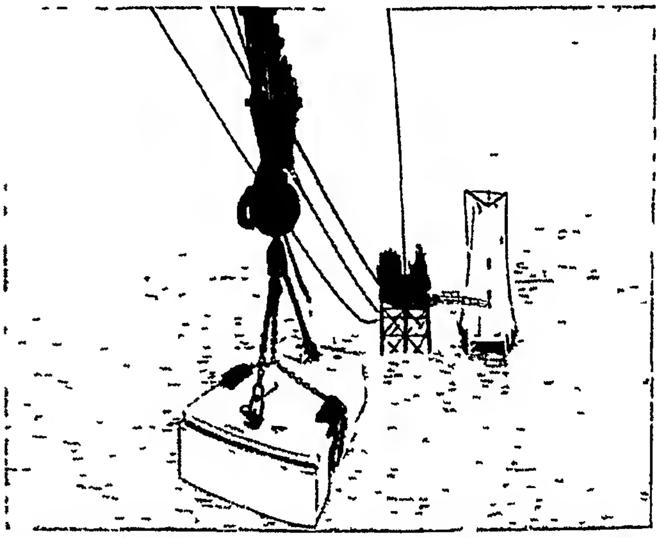
BIRTH AND GROWTH OF A MODERN LIGHTHOUSE



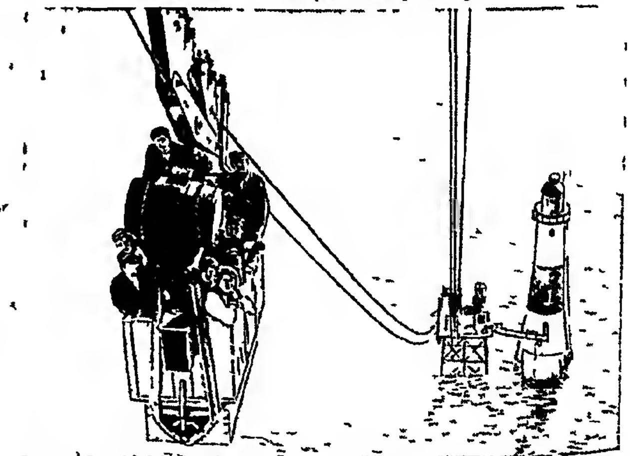
INTERIOR PLAN OF A LIGHTHOUSE This shows you how a modern lighthouse of the stone masonry type is built Notice how heavy the walls are at the bottom where they have to withstand the heaviest shocks



LAYING THE FOUNDATION This part of the work often has to be conducted from a temporary stage set up beside the lighthouse site When the seas are rough, this work is extremely dangerous



DELIVERING MATERIALS Building materials for the lighthouse sometimes have to be delivered along cables, strung like giant spiders' webs from nearby cliffs Here we see a great block of stone on its perilous journey

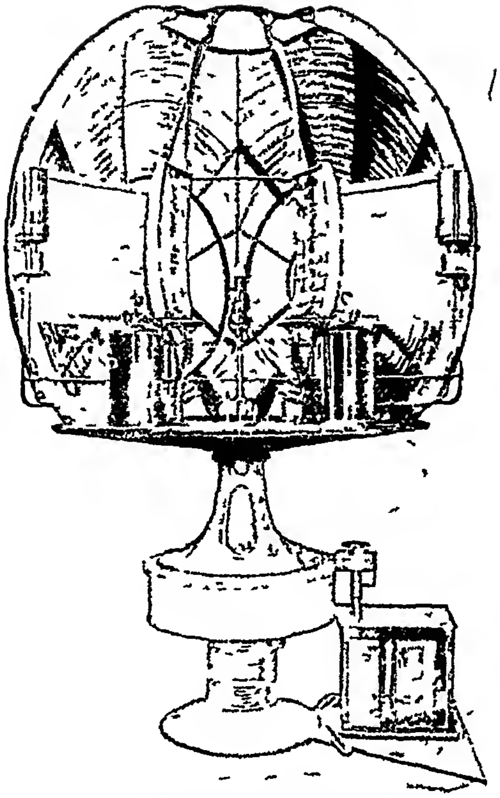


A THRILLING TRIP TO WORK Workmen as well as materials must make that dizzy trip along the cables, when such lighthouses as the Beachy Head light on the southern coast of England are being erected

The light itself, formerly made by means of coal fires, candles and whale oil lamps, is today produced by big lamps burning vaporized paraffin, gas, acetylene or electricity The latest type of lighthouse lantern is automatic, worked by a patent valve Such a beacon can be left entirely unattended

In the earliest lighthouses, centuries before the Christian era, the light came from a brazier of burning coals hung from a pole As far back as the 7th century B C there was a lighthouse at Cape Sigeum, in the Dardanelles The most famous lighthouse of antiquity was the tower built on the island of Pharos in the bay of Alexandria in the 3rd century B C

This was considered one of the Seven Wonders of the World, and for a long time the name "pharos" was given to all lighthouses At Boulogne, on the French side of the English Channel, the Romans built a great tower 192 feet round and 200 feet high, which guided mariners for more than 1,400 years

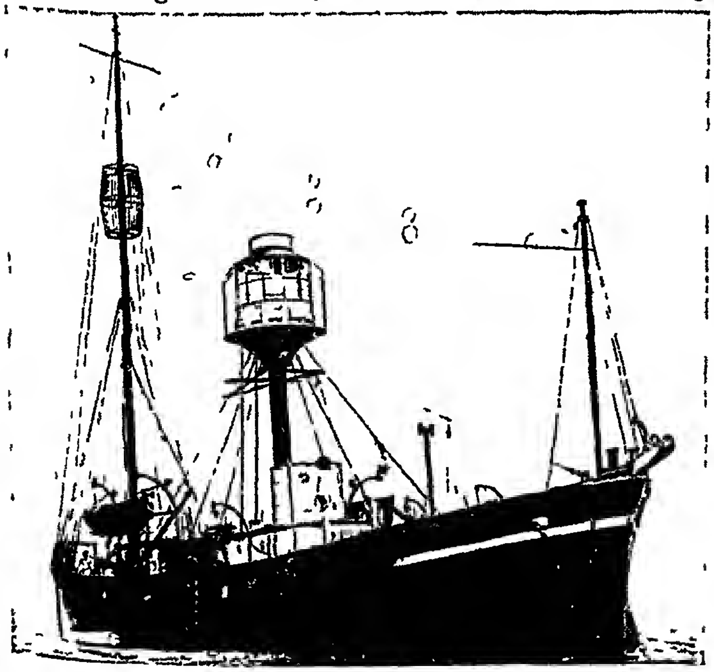


THE MODERN 'LANTERN'

The light comes from that little acetylene-burning gas mantle in the centre Its rays are caught up and magnified by the complicated system of reflectors and lenses at the sides and shot out in horizontal beams, visible at great distances At the lower right-hand side you can see the clock-work which revolves the lantern so that its beams can be seen at regular intervals

Among the most famous lights off the British coasts today are the Eddystone (*q v*), thirteen miles off Plymouth, the Fastnet, off S W Ireland, the Lizard (Cornwall), Bishop Rock in the Scillies, and Beachy Head, off the Sussex coast Those in England and Wales come under the direct control of Trinity House, a body granted a charter by King Henry VIII in 1514

Off dangerous coasts and at the entrance to harbours where lighthouses cannot be built, strong steel lightships are moored They are quite different from their ancestors—the old Roman galleys with signal fires sputtering in grilled metal baskets at their mastheads Lightships today have a single hollow steel mast that contains a ladder leading to the lantern Some of these vessels are fitted with a wireless directional beam and submarine gongs



THE LIGHTSHIP 'ALBATROSS'

Besides sending her message of warning to ships by a flashing light or fog-horn, this up-to-date lightship at the entrance to Dublin Bay, Ireland, sends out wireless signals These signals are repeated by apparatus which causes vibrations in the water that can be picked up by a direction-finding receiver fitted on many ships From the difference in the times of arrival of the air-signal and water-signal, the distance of the lightship can be found

The work of lighthouses and lightships is supplemented by a great variety of other signals, including the various types of buoys (*q v*)

The growth of airways has led to the development of special lights to guide the airman on his way at night These include beacons, filled with neon or a similar gas, flashing route beacons, aerodrome boundary lights, obstruction lights, and floodlights of tremendous candle power to illuminate the actual landing-area (*See* Electric Lighting)

Lightning. Benjamin Franklin was the first to prove by his kite and other experiments that lightning is caused by electrical discharges between clouds, or between clouds and the earth We know that the air and the earth's surface are charged with electricity of opposite kinds—positive and negative—and that there is a constant interchange of electricity going on between them Ordinarily this

does not manifest itself as lightning, because moist air is a fairly good conductor (*See* Electricity, Franklin)

When the air becomes dry, however, the interchange becomes more difficult with the result that the air becomes heavily charged, and enormous quantities of electricity accumulate in clouds Finally, when the charge becomes so great that it can overcome the resistance of the atmosphere, the electricity leaps violently across the gap to a hill-top, church spire, house roof, or to another cloud charged with an opposite kind of electricity, and there is a great flash, like the spark that leaps between opposite poles of an electrical machine, only infinitely greater

The heat produced by the discharge causes the particles of air to expand suddenly and compress those beyond, and when the current has passed the air contracts just as suddenly As it rolls back from all sides to fill the partial vacuum, the inrushing air "collides" with itself, so to speak, and causes thunder

Photographers have obtained wonderful pictures of lightning, showing us flashes of irregular wavy outline filling the heavens, often branching into a multitude of ramifications like the limbs of a tree Sometimes the flash descends to the earth in long spirals or ribbons, sometimes in a thick mass of strands like an unravelled rope Such flashes are called *chain*, *forked*, or *zigzag* lightning *Sheet* or *summer* lightning is a sudden glow on the horizon, and is usually merely the reflection of distant chain lightning A third very rare kind of lightning is *ball* lightning, which looks like a ball of fire moving slowly just above the ground, as seen at night on a spar or yard of a ship it is often called "St Elmo's fire"

EIFFEL TOWER AS LIGHTNING CONDUCTOR

During the twenty-two minutes for which this plate was exposed six flashes of lightning were recorded, three of which used the tower as a path to earth Being entirely made of metal, and therefore a good conductor of electricity, the tower was not damaged Calculations show that one such flash has sufficient power to light a city of the size of Birmingham for two months

Photo Dr W J S Lockyer

Lightning rods of iron or copper were invented by Franklin to conduct lightning harmlessly from roofs to the ground To be effective, a great number of metal points must be scattered over the roof When a wireless set is "on," and a thunderstorm breaks, it is usual to "earth" the aerial to avoid any danger Lofty office buildings are often struck, but with little damage, for their steel skeletons serve as lightning conductors Ships usually escape damage because the masts and stays act in a similar manner

Lilac. This tree will always be one of the great favourites for the garden, for there is no other tree whose flowers in spring show so beautiful a shade of purple or have so fragrant a scent The lilac (*Syringa vulgaris*) has been grown in England for hundreds of years It is a relative of the privet and the ash,

and, like them, a member of the order *Oleaceae* Besides the common species, there is the Persian lilac, which is a hybrid between the common species and the wild lilac of Persia This has rather smaller and darker flowers than the common species, and the growth of the tree is more compact and twiggy The common lilac often becomes almost choked by the exuberance of its own growth of suckers, and it is therefore one of those trees which the gardener cuts back very severely every second year or so When it is not in flower, you can tell it by its smooth, pale green, heart-shaped leaves, with entire margins, and when these, too, have fallen, the buds, arranged very neatly in opposite pairs on the shoots, and bright green in colour, easily distinguish it All lilacs are valuable for their hardiness and their early flowering, and, as they grow to a good size, they can be made to form useful hedges round a plot

BEAUTIFUL LILAC BLOSSOM

Not all lilacs are the colour that their name implies, and the fine spray of blossom you see here is one of the specially developed white species Such lilacs come into bloom very early in the year, and are extremely popular for decoration

Photo E J Tyler

Lille, (Pron lēl), FRANCE In 1914, when the Germans entered Lille, the largest and most prosperous city of northern France, on the river Deule, seven miles from the Belgian frontier, they found a modern city of more than 200,000 inhabitants, noted for its thriving textile and iron manufactures, its historic old churches, its Palais des Beaux Arts, one of the richest picture galleries in France, and its wonderful library

For the next four years it led a miserable existence—this conquered city of wide tree-lined avenues and spacious squares, fringed by handsome buildings and residences, in a region marked by forests of tall smoke-stacks and quaint windmills, criss-crossed by canals and railways The city was put on almost starvation rations, enormous tribute of money was levied, and—worst of all—thousands of young women, old men and boys were forcibly deported into practical slavery to work for the German enemy Buildings were ruined by shells, homes went up in flames, and valuable machinery in the city's famous mills, which had made this district one of the busiest manufacturing regions in Europe, was carried off to Germany

After the Treaty of Versailles France energetically set about the task of reconstructing her war-devastated areas, for which purpose the enormous reparations exacted from defeated Germany were used unstintedly One result is to be seen in the revivified Lille of today, a centre of industry more thriving and more beautiful than ever

For centuries Lille has been noted for the making of fine lawn, linen and damask cloths, and flax thread for lace-making and for sewing, "lisle" thread indeed gets its name from the city Cotton manufactures are also important, as is the making of ribbons and velvet The city also has locomotive and bridge-building works, and manufactures beet sugar chemicals, tobacco, soap, etc Among its educational institutions is the university

In the 12th century, Lille was one of the principal commercial cities of Flanders and in the next century it suffered in the struggles between the Flemish counts and the French crown As a Burgundian possession it again became prosperous After passing into the hands of Spain, it was recovered in 1667 by Louis XIV of France In the War of the Spanish Succession it was taken by Marlborough and Prince Eugene but the Treaty of Utrecht restored it to France In 1792 the Austrians bombarded Lille continuously for nine days and nights, but they were unable to capture the city Lille's population today is about 205,000

Lily. One or other of the many species of this plant is nearly always in flower, including some of the favourite flowers of the garden The white lily stands for purity, and artists for

centuries have pictured the angel Gabriel coming to the Virgin Mary with a spray of lilies in his hand, to announce that she is to be the mother of the Christ-child—hence this species *Lilium candidum*, is known as the Madonna lily This plant grows wild in southern Europe and is hardy enough to thrive in British gardens

The Madonna was the original Easter lily, but since its flowers often failed to appear in time for Easter, its place has been largely taken by the Bermuda lily (*L longiflorum*) This can be relied on to bloom early in the spring in its native islands or in hothouses in the colder climates of Europe In the Bermudas these lilies are grown in large quantities, and the great fields of these lovely flowers make an enchanting picture It must not be confused with the arum lily

Among popular varieties of coloured lilies are the tiger lily, a native of Japan, which bears dark-red purplish-spotted flowers, the Turk's cap, whose orange flowers have red spots, the Siberian coral lily, which has brilliant scarlet flowers, the golden-rayed lily of Japan, with yellow-banded purple-spotted white flowers, and the showy lily, also a Japanese species, with red-dotted pinkish flowers The giant lily of India, which has huge funnel-shaped purple-stained flowers, grows from ten to fourteen feet high, while the other species range from two to five feet

The lily family (*Liliaceae*) is one of the most important orders of plants, and it is, moreover, usually regarded as typical of the division of the Monocotyledons Not only are many of its members, including asparagus, onion, leek, garlic, chives, etc, used for food, but among the garden flowers the lily of the valley, tulip, hyacinth, fritillary, and many other favourites all belong to this family

The true lilies of the genus *Lilium* are marked by an erect stem, narrow sessile leaves with alternate, scattered, or whorled arrangement, and large showy bell-shaped or trumpet-shaped six-parted flowers, enclosing six stamens and a seed-vessel The beautiful white calla lily or arum lily (*Richardia aethiopica*) is not a lily at all, but a herb of the order *Araceae* The water-lilies, too, belong to a different group

Lima, (Pron lē′-ma), Peru In the magnificent capital of Peru, a rain storm is as much feared as an earthquake For the houses, with walls of adobe four to six feet thick, are almost earthquake-proof, and rarely take fire, but a heavy

FOUR LOVELY LILIES FROM GREENHOUSE AND GARDEN

Lilies are often grown in greenhouses, but those that you can plant in your own garden are no less lovely than the more tender varieties Those shown above are (1) the orange-red tiger lily, always a favourite, (2) the lovely Japanese lily, (3) a white, crimson-spotted species, Speciosum rubrum, and (4) the Madonna lily None of these is at all difficult to grow in England

Photos E J Tyler R Malby

Dorien Leigh

IN THE CITY OF LIMA

The beautiful cathedral of Lima dominates the Plaza de Armas, or Plaza Mayor, in the middle of the city. It was founded by Pizarro, the great Spanish adventurer, who, when he was over fifty years of age, conquered Peru for Spain. In one of the chapels of the cathedral his remains are buried.

deluge would reduce most of the town to a mud heap. It is fortunate indeed that almost from year's end to year's end the city is without rain.

There are several handsome promenades in the city, and numerous public squares. On one stands the cathedral—the finest of the 70 churches in Lima, and one of the most noteworthy in Spanish America—with a beautiful Moorish façade and two lofty towers.

Lima lies in a broad valley, six miles east of Callao, its port, with which it is connected by two railways. Earthquakes have been frequent and disastrous, and the dense fogs which prevail in winter render the climate uncomfortable and at times unhealthy. In the city is the national university of San Marcos—the oldest in the Americas—which received its charter from the Emperor Charles V in 1551.

This city of earthquakes and fogs was founded in 1535 by Pizarro, the conqueror of Peru, whose remains lie in a chapel of the cathedral. Under Spanish rule Lima was the principal city of South America. During the Chilean occupation in 1881-83 many of its ancient monuments were destroyed. The manufacture of cotton and woollen textiles, sugar, chocolate, cigars and cigarettes, paper, pottery, dyestuffs, etc., is carried on.

"Lima" is a corrupted pronunciation of "Rimac," the name of the river on which the city is situated. The population is about 500,000.

Lime. Often, among the limestone hills, you may come across curious little brick-built kilns, without much in the way of a visible chimney, and with a smoke-blackened tunnel-like entrance. Usually such kilns are quite deserted and are merely signs of a forgotten, or rather a transformed, industry. For these are lime-kilns, in which the lime used to be burned by the local people for agricultural or building purposes. But now the industry of lime-burning, intimately connected as it is with those of cement- and concrete making, has been centralized, and where a district may have supported twenty or more little kilns, it now has one vast cement works. That is why you seldom see a small individual lime-kiln being used, although lime itself is still as necessary and valuable a product as ever. Among lime's manifold uses may be mentioned processes such as removing hair from hides and correcting acidity in soils, and in mortar and plaster making.

To make mortar, lime is "slaked" by adding water, and coarse sand, cinders, or pulverized stone are mixed in. As the mixture dries, it absorbs carbon dioxide from the air to form calcium carbonate, and also combines with the silica of the sand to form calcium silicate. These substances bind the bricks or stones together. Quicklime exposed to air is ruined for mortar making by absorption of carbon dioxide (air-slaking). Lime plaster is made by mixing hair with water-slaked lime.

Limelights on the Stage

Pure calcium oxide is formed by melting limestone in an electric furnace. Under intense heat this gives a strong white light, and limelights produced in this way (also called calcium lights or Drummond lights) were formerly used for stage lighting.

A solution of calcium hydroxide in water is called limewater. This is used in medicine to correct acidity, to prevent milk from curdling in large lumps, and with certain oils, as the emollient "carron oil" for burns. Limewater reveals the presence of carbon dioxide by becoming cloudy. It is an antidote for poisoning by mineral or oxalic acids.

Lime chemically, is calcium oxide (CaO), this product being obtained when really good, pure limestone is burned. It is then known as

"quicklime" With water it crumbles away, giving out a great deal of heat, and the resultant product is called "slaked" lime or, chemically, the hydroxide of calcium, $Ca(OH)_2$ *See* Cement

Lime (LINDEN) Sometimes, beneath a tall shady tree, you may find in summer-time a regular collection of insects, chiefly humble-bees and hive-bees, all more or less dead, or crawling feebly about This is almost certain to be a lime tree, and the bees and other insects are just suffering through their own greed For the lime tree (*Tilia europaea*) which is also sometimes called the linden, has wonderfully sweet flowers which have an unusual amount of sugar nectar, and a strong smell as well These attract the insects, which either drink until they fall to the ground in a coma, or are else eaten by the tits and other small birds

The common lime is not a native of England, although it has been over here for hundreds of years It is a favourite tree for avenues, and lives to a considerable age, growing tall and stately with a great girth of bole Yet its timber is almost useless, being very soft, and valuable only as wood for the carver

The leaves of the lime are heart-shaped, large, and pale green, and they give a wonderfully cool shade The flowers are small, greenish or yellow in colour, and attached in little clusters to a leaf-like *scape*, which remains on the trees long after the leaves have fallen This scape then bears the fruits, hard little objects like nuts with a rather woolly covering

Besides the common lime, there is the small-leaved lime (*T parvifolia*), which is native to the West of England in the Wye valley, and a third species you sometimes see is the broad-leaved lime (*T platyphyllos*) But, apart from the size of the leaves, it is not very easy to distinguish these three species from each other, and you will need to know a lot about trees before you can do it In America there are various species of lime, of which the bass-wood (*T americana*) is an important timber tree, providing wood for utensils of all sorts as well as pulp for paper

Trees Grown for Lime Juice

These trees must not be confused with another lime tree, which is a native of south-eastern Asia, particularly India This is the tree, *Citrus aurantifolia*, a member of the orange family, which provides the lime juice so popular in summer drinks It is now largely grown in the United States, the West Indies, and Mexico

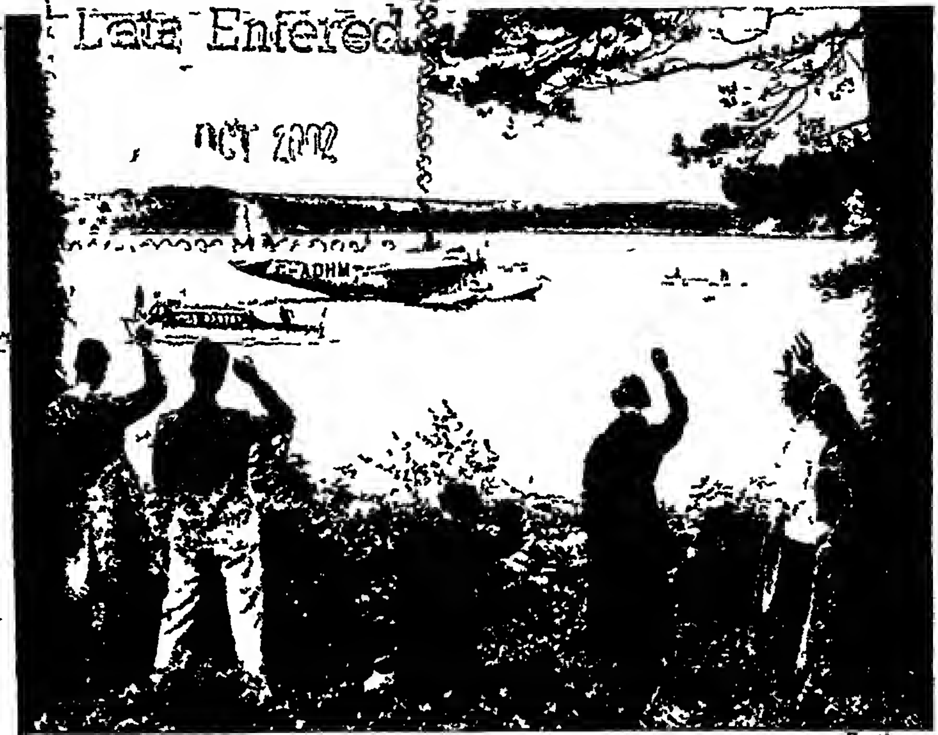
Lime juice, obtained from the yellow, lemon-like fruits, and often concentrated by evaporation, is marketed both for flavouring and as a source of citric acid British sailors were formerly called "lime-juicers" because of the British law requiring a regular allowance of lime or lemon juice at sea to prevent scurvy (*See* Orange, Vitamins)

Limerick, Co of EIRE In the province of Munster, adjoining Tipperary, Kerry, and Cork on the south and west, and having for its northern boundary the beautiful lower reaches of the river Shannon, lies Limerick, the county of the Golden Vale, the most fertile tract in all Ireland This prolific meadow land is given over to grazing, and on the large farms along Shannon's shores many of the finest cattle in Ireland are reared The Shannon, navigable up to Limerick city, is a sporting river well stocked with sea trout In the south rise the Galtee Mountains Oats and potatoes are the staple

H Bastin

FLOWERING LIME THAT THE BEES LOVE

Few trees attract insects so much as the common lime, for its sweet-smelling blossoms exude sticky substances that insects delight to feed on Here is a big spray of the common lime, with its broad, heart-shaped leaves and small yellowish flowers, each group of which is supported by a greenish bract This lime is not a native of Britain



Keystone

ATLANTIC TRANSPORT FROM COUNTY LIMERICK

At Foynes, in Co Limerick, is the temporary base used by the British and American flying-boats on the first experimental flights across the Atlantic to and from Newfoundland Above, in the sheltered roadstead between the mainland and Foynes Island, is the Caledonia before its first crossing in July, 1937

crops, but more and more land is being given to pastures on which great numbers of live-stock of all kinds are fattened for market Milling, lace-making—for which Limerick is celebrated—and bacon-curing are important, as also is the salmon fishery The small town of Foynes on the Shannon estuary has gained additional importance as the temporary European terminus of the trans atlantic air-mail experiments inaugurated in 1937 At Ardnacrusha is the giant power station of the Shannon hydro electric plant, which supplies electricity to the whole country

Limerick (population, 39,000), the county town, is one of the oldest chartered cities in Ireland It is best remembered for the siege of 1690, when the city withstood the attempts of King William's army to force the line of the Shannon

County Limerick covers over 1,030 sq miles, and has a population of 99,622

Limericks. You all know these verses, with their jingling metre and rhymes between the first, second and fifth, and the third and fourth lines This is a famous example

There was a young lady of Riga,
Who smiled as she rode on a tiger
They returned from the ride
With the lady inside,
And the smile on the face of the tiger

But, actually, a great many people don't realize that this is really the *only* metre and rhythm that a Limerick can have You often see examples in which the last line, especially, is halt and lame, and the whole verse loses its point and, so to speak, drags its tail A good Limerick has the greatest possible sting in its tail Even most of the famous ones created by Edward Lear, who first popularized this form of verse, have this failing for he was very prone to have the last line terminating in the same word as the first—a bad fault, because, as you can see, it wastes a chance for further humour and slows the whole verse down (*See* Lear, Edward)

It is said that the Limerick originated at parties in the part of Ireland that bears its name, when each guest would compose a line towards a verse in this metre, the whole ending with the chorus, "Will you come up to Limerick ?" On the other hand, another and, perhaps, more plausible theory is that the form was brought over from France by Irish mercenary soldiers, it had certainly existed on the Continent long before it reached Britain Recently, Limerick competitions have been very popular in the daily press

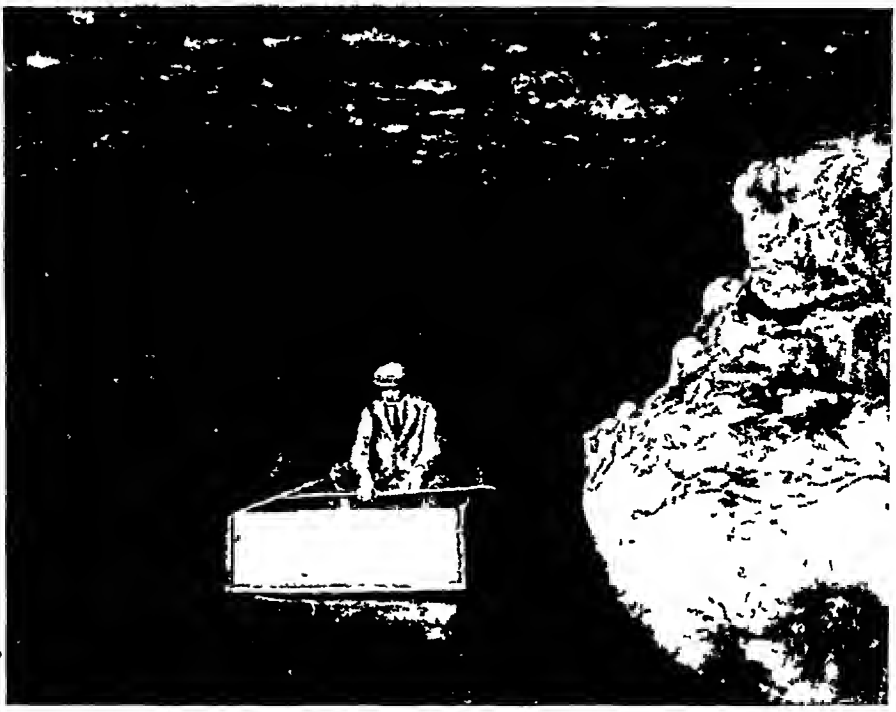
Limestone. One of the commonest and most useful rocks is limestone, which is used for building, for road-making, as a flux in smelting iron and lead ores, as an ingredient in Portland cement and, when burnt to lime, for making mortar and chloride of lime, as well as in numerous important industrial processes

Limestone is a rock formed under water, and is composed chiefly of calcium carbonate ($CaCO_3$) Most limestones are made of shells of molluscs and foraminifera, coral skeletons, fragments of sea-lilies, etc , indeed, the fossilized shells of all types are plainly to be seen in some limestones Oolitic limestone resembles in texture the eggs of fish (whence its name, from Greek ōon, "egg"), and is a good building stone Other limestones are formed by the deposit of calcium carbonate from hard water

Chalk is a white soft limestone composed chiefly of the shells of foraminifera (*See* Chalk) Dolomite is a limestone which contains carbonate of magnesium as well as calcium Marble is a "metamorphic' limestone which has been

crystallized under pressure In England, the South Downs, the Chilterns, and the other chalk ranges (*see* Chalk), the Cotswolds and the coast scenery of Dorset, the greater part of the Pennine chain, including the Yorkshire moors and much of the Derbyshire dale scenery—all are composed chiefly of limestone, and so is much of the Silurian series of Wales

The Carboniferous limestones are best seen in Yorkshire, in the central part of the Pennines The limestone is easily worn by water and weather, producing the most curious formations in the rocks There are rounded, smooth surfaces, breaking off into a sudden, knife-like edge, which may lead to a crevasse in the rock, many feet in depth and only a few inches across Such crevasses often lead into great caves, and it is in these limestone districts especially that the finest caves and "pot-holes" occur, the exploration of which is a popular sport



ON AN UNDERGROUND LAKE IN LIMESTONE COUNTRY

Limestone is peculiar among rocks in that streams can cut deep channels in it, and underground water often makes great caves and lakes The subterranean lake of Ingleborough Mountain, in which the punt seen above is floating, is 300 yards long and 20 feet wide, and is so deep that no plumb-line has ever yet touched bottom

The Jurassic limestones of the Cotswolds give a very different type of scenery This is the greatest of all our building stones (*See also* Geology, Marble, Pennine Chain)

From LOG CABIN *to* WHITE HOUSE

The greatest of American presidents, save, perhaps, for George Washington, and inventor of the slogan "Government of the people, for the people, by the people," Lincoln was a prime founder of modern democracy

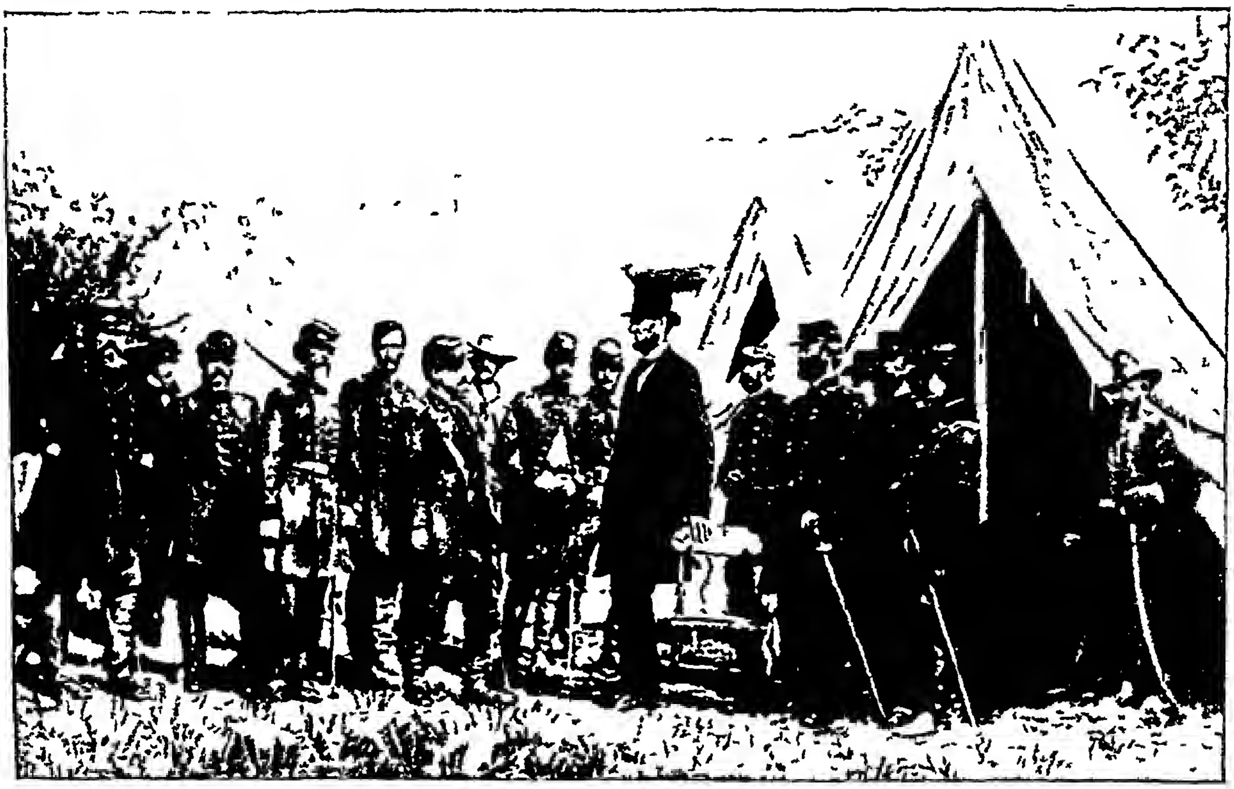
Lincoln, ABRAHAM (1809–1865) Lincoln was born in Hardin County, Kentucky, U S A, on February 12, 1809, when the so-called pioneer era of American history was just emerging from the Indian fighting and hunting period At twenty-one Lincoln possessed only six books—the Bible, "Pilgrim's Progress," "Aesop's Fables," "The Arabian Nights," a life of Washington, and the statutes of Indiana He had, also, from seeing an occasional newspaper, committed to memory a number of great American speeches

The conditions of life in southern Indiana, whither the family removed in 1816, were as primitive as in Kentucky Here, on the farm near the Ohio River, Lincoln's brave young mother died for lack of medical attendance, in 1818 The boy of nine helped his father, a cabinet-maker by trade, to make the rough coffin in which his mother was buried Then he wrote his first letter, one to an itinerant preacher, asking him to stop on his next round and say a prayer over her grave To his mother, who urged him to "learn all he could and be of some account in the world," and to his capable stepmother, with her sympathy and insight, he owed much in the shaping of his character

In the autumn of 1830 he tied his extra shirts and home-knit socks in a big cotton handkerchief, and turned his face to the nearest settlement of New Salem—to begin life as a man

He made two voyages on "flat-boats" to New Orleans, served as captain of a company of volunteers in the Black Hawk War, was a clerk in a store, acted as village postmaster, carrying all the mail in his hat, and learned surveying

LINCOLN AMONG HIS SOLDIERS AND STATESMEN



Abraham Lincoln, who was President of the United States during the Civil War between North and South, made it his business to become personally acquainted with the leaders of the Federal Army, visiting them in the field as often as possible He had appointed the generals, and he wanted to assure himself that they were capable as well as brave In this photograph he is seen among the generals of the army of the Potomac, shortly after the battle of Antietam, fought on September 17, 1862—one of the most severe of the American Civil War, though its result was indecisive

Just after the battle of Antietam, Lincoln issued his famous Proclamation of Emancipation of the negro slaves He is here seen reading it to the members of his Cabinet, the figures from left to right being Stanton, Chase, Lincoln, Welles, Smith (standing), Seward (seated), Blair and Bates The proclamation called on the Southern States to return to their allegiance before the end of the year, otherwise their slaves would be declared free men The Confederates (or Southerners) ignored the injunction, and the proclamation came into force, though it was effective only in those states which were under the control of the Federal Government

Self-educated, he passed the examination for permission to practise law in 1837. He had now entered political life, but much of his time was needed to attend to his growing practice. In 1846 he served one term in Congress, but the administration was Democratic and he was a Whig, so there was little chance to distinguish himself. From 1848 to 1854 Lincoln was out of politics, but he was making a reputation as a lawyer and as an orator. The slavery question now became prominent, and in his speech in the Republican State Convention in 1858 Lincoln had made an observation that set the nation thinking. "A house divided against itself," said he, "cannot stand. I believe this Government cannot endure permanently, half slave and half free." In the seven public debates in various parts of Illinois between Lincoln and S. A. Douglas, who upheld slavery, Lincoln proved superior to his opponent, who had been looked upon as probably the next President. In May, 1860 the Republican National Convention nominated Lincoln for President, and he was elected by a great majority.

Lincoln was not pledged to abolish slavery—only to preserve the Union and to prevent the spread of slavery. Even after the war began, the government offered to purchase the freedom of slaves in the slave states that remained loyal—Kentucky, West Virginia, and Missouri. But the secession movement began as soon as Lincoln's election, in November, 1860, was assured. When his inauguration took place, on March 4, 1861, seven states had seceded and formed the Confederate Government. In his inaugural address he declared that the Federal Government would not attack the rebellious states, but it would "defend, protect, and preserve if attacked." A month later the president mobilized the regular army and issued a call for volunteers. Within a month all the states had arrayed themselves on one side or the other, and the Civil War that was to last for four terrible years had begun.

WORKING OUT A PROBLEM

As paper and pencils were scarce, the schoolboy Abraham Lincoln would work out his problems with a piece of chalk, using a shovel as an exercise book

Lincoln's part was to guide the ship of state through the troubled waters of civil war. For two years he kept consistently to the task of preserving the Union. On January 1, 1863, he issued the Slave Emancipation Proclamation, and from then on the prosecution of the war had the added purpose of freeing the slaves.

The battle of Gettysburg was fought in July, 1863. In the following November the battlefield was dedicated as a national cemetery. Lincoln's brief speech on that occasion will ever remain one of the greatest speeches ever uttered, both for its lofty sentiment and for its matchless literary style.

Love, reverence, and gratitude were in the votes by which Lincoln was re-elected in 1864, but he was assailed by partisan opponents almost as bitterly as Washington had been during his second administration. But Lincoln, the Union candidate, received 212 electoral votes to 21 cast for his Democratic rival. In his second inaugural address, President Lincoln set forth the moral significance of the conflict then drawing to a close, and declared that the task would be finished "with malice toward none, with charity for all."

On April 14, 1865, five days after Lee's surrender President Lincoln was shot in Ford's Theatre, Washington, by John Wilkes Booth, an actor, and died next morning. In 1920 a statue of Abraham Lincoln was placed opposite Westminster Abbey.

Lincolnshire, ENGLISH Co. Lying between the Wash and the Humber, this county of East Anglia (the second largest in England) comprises, within an area of 2,665 square miles, what is perhaps the most extensive and richest tract of uniformly fertile farming land in the whole of England. The county is divided into three "Parts"—Lindsey (in which are the Wolds), Kesteven, and Holland. It is drained by three rivers—the Trent, Witham, and Welland.

A great portion of Lincolnshire, lying within the region of the fens, has been reclaimed either from the sea or from the ancient marsh, and the

fertility of this silt is extraordinary It might almost be said that on market days the market-places of Lincoln, Boston, Spalding, Louth and Stamford are literally bursting with fatness The sugar-beet industry has added greatly to the county's prosperity in recent years The growing of potatoes and bulbs is also particularly widespread

The flatness of the land has led to the construction of a large number of aerodromes, the most notable of which is Cranwell, home of the R A F College

Lincolnshire is rich in historical interest, and Lincoln, the county town (with a population of 66,000) was one of the great strongholds of the Romans and afterwards of the Danes This city has great agricultural implement factories and a noble 13th-century cathedral

The largest town in Lincolnshire is Grimsby (population, 92,000), one of the great fishing ports of England Another seaside town is Skegness, which is "so bracing" for holiday-makers Grantham, like Lincoln, stands on the river Witham, and is an important railway junction It has an ancient church (St Wulfram) and market cross, and two inns of note (the Angel and the George) Boston, which gave its name to the greatest city of Massachusetts, U S A, is a contraction of Botolph's-town The western tower of St Botolph's Church is popularly known as the "Boston Stump" The population of the county numbers about 465,000

J Dixon Scott

A LINCOLNSHIRE LANDMARK

The parish church of Boston on the coast of Lincolnshire, one of the largest in England, has a tower 288 feet high Crowned by an octagonal lantern, it is known as the "Boston Stump," and forms a landmark visible 30 miles out at sea

Lindbergh, CHARLES AUGUSTUS (born 1902) On May 20 and 21, 1927, Charles Lindbergh, then 25 years old, flew alone in a small single engined monoplane from New York to Paris He was the first aviator to conquer the Atlantic Ocean alone, and his youth, skill, and courage captured the world's imagination and made the adventure an epic of heroism

In March, 1924, he enlisted as a flying cadet in the United States Army Later, in 1925, Lindbergh tested aeroplanes for a St Louis firm When this firm was awarded the contract for flying the mail between Chicago and St Louis, Lindbergh made the first flight over the route

Seasoned by more than 1,500 hours of flying, Lindbergh decided to try for the prize offered since 1919 for the first non-stop flight between New York and Paris Early in 1927 he went to San Diego to superintend the building of a monoplane, which he named the Spirit of St Louis Lindbergh put his new 'plane through severe tests On May 10, 1927, he flew it from San Diego to St Louis, and on May 12 he leaped to New York, setting up a new coast-to-coast record

Early in the morning of May 20 Lindbergh climbed into the Spirit of St Louis at Roosevelt Field on Long Island, and sharp at 7 52 a m he took off, vanishing in a drizzle Just before nightfall Lindbergh passed over St John's, Newfoundland, on the way to the open sea Through fog, rain, and sleet the 'plane throbbed on, true to its course At 10 p m, local time, on May 21, a crowd at Le Bourget Airport, Paris, heard the drone of an engine Twenty minutes later the little machine landed, having flown 3,600 miles in 33 hours and 29 minutes

From the cabin of the 'plane Lindbergh emerged, now a world hero At 25 he had performed a greater feat than any other pilot in the short history of aviation

Lindbergh soon indicated that he would devote his career largely to the task of inspiring confidence in the aeroplane as a practical means of world-wide transportation He flew the Spirit of St Louis to cities in every state of the U S A and then made a good-will flight over Mexico, and the West Indies He was made air counsel to the Department of Commerce

In 1931 Lindbergh and his wife blazed a northern air route from New York to China Mrs Lindbergh was radio operator, navigator and co pilot Her delightful book, "North to

the Orient," describes the flight In 1933 the Lindberghs made a 30,000-mile air trip to study air lanes and bases for commercial transatlantic flying In 1937 they surveyed a possible air route from England to India

Lindbergh also made contributions to archaeology and the technique of medical research In 1929, flying over Yucatan, he photographed hitherto unknown ruins of the Mayan civilization Working with Dr Alexis Carrel of the Rockefeller Institute for Medical Research, he developed a new method for separating red corpuscles from blood serum In 1935 he perfected an "artificial heart and lungs"

Along with fame, bitter tragedy came to the Lindberghs Their first child, who was born in 1930, was kidnapped and killed in 1932 In 1935, to escape public attention, the Lindberghs settled in England, though they kept their American citizenship

G P A
LINDBERGH, AMERICA'S AIR HERO
When this photograph was taken at New York, Charles Lindbergh was practically unknown But no airman since the earliest days of flying has so startled the world as did "Lindy" with his amazing solo flight across the Atlantic

Linen. "Purple and fine linen" was the raiment of princes in Biblical days, and fine linen is a luxury still The glossy lustre of fine table damask rivals silk brocade The snowy whiteness of bleached linen and its smooth, dirt-repelling surface make it the preferred material for shirts, collars, and handkerchiefs Because linen is an excellent conductor of heat, linen sheets and garments are delightfully cool for summer Linen towels are preferable to cotton because they absorb moisture more readily Its great tensile strength makes linen desirable for aeroplane cloth, at one end of the scale, and for the most delicate hand-made laces at the other

The quickest test for the purity of linen, and the one which, though not infallible, is generally employed, is the touch of the moistened finger, if the moisture comes through slowly, the fabric is probably in part cotton Another test is to set a thread on fire, cotton will blaze, while linen will smoulder The surest method is to boil all the dressing out of a sample and then put it in a 50 per cent solution of caustic soda, this will turn cotton light yellow but linen will become almost brown

The valley of the Nile was the original home of flax and linen Some of the chief centres of linen manufacture today are Belfast, Dundee, Dunfermline, Leeds, and certain towns in northern France, Belgium, and Germany (*See* illus under Ireland, Northern)

Linné, CARL VON (Pron lin-nā) (1707–1778) As you read the numerous articles in this book dealing with living things, you will notice that they all have scientific names, consisting of two parts, a generic and a specific name Thus the crow is *Corvus corone* These names are given according to the "Linnean system" of nomenclature, and it was invented by Carl von Linné Indeed, the title of "The Father of Modern Botany" may well go to the first and greatest of classifiers, so fundamental was the work of the great Linnaeus—to use the Latinized form of his name

For it is to Linnaeus that we owe the system of nomenclature now used to designate every plant, he it was who first worked out, perhaps roughly and inaccurately in detail, the great system of natural classes, orders, families, sub-families, genera, species and varieties, upon which botanical study was built, and it was Linnaeus who invented the "binomial" naming of plants, *i e* the use of two Latin names, one for genus, one for species, by which every plant is labelled

Carl Linné—he was later ennobled as Carl von Linné—was born at the little village of Reashult, in Sweden, May 23, 1707 Almost as soon as he could talk the boy knew the names of the plants in his father's garden and in the neighbourhood He was first apprenticed to a cobbler, but through his schoolmaster applied to the university of Upsala for a post as gardener Instead he was made assistant lecturer and keeper of the botanic gardens He later

YOUNG LINNAEUS TIRED OUT AFTER A DAY IN THE FIELDS
Many were the delightful days young Carl Linnaeus (later von Linne) would spend wandering in the fields and lanes round his home in Sweden in search of some new object for his beloved botanical collection Even as a child, plants and flowers interested him far more than toys, and what was first a youthful hobby became the study of a long lifetime of hard work
Reproduced from Linnaeus by B D Jackson

left Sweden for Holland, where he studied medicine and where his first great work, "Flora Lapponica," was published in 1737 His work attracted the attention of a Dutch banker, who made him director of his extensive gardens and greenhouses It was during his stay in Holland that Linne gave the world his most important works, "Systema Naturae," "Fundamenta Botanica," and "Genera Plantarum"

After a visit to England, another stay in the Netherlands, and a visit to France, Linne returned to Sweden In 1742 he was given the chair of botany at Upsala, having already held that of medicine At Upsala Linne remained for the rest of his life, and it was there that he died Jan 10, 1778 In his various works Linne set out his now universally accepted system, he made mistakes in details, as was to be expected of a pioneer in this field, but none in fundamental principles, which remain as the basis of modern systematization, though some of his ideas have been modified and many of his names abandoned His manuscripts, library, and collections of plants were obtained in perpetuity by the Linnean Society of London His published works number more than 180

C W Teager

LINNET, A WAYSIDE SONGSTER
One of the most common of all birds in agricultural country is the linnet, for it loves to nest in the wayside hedgerow The cock bird, a handsome fellow with rosy crown and breast sings delightfully, and was formerly popular as a cage bird

Linnet. This is one of the commonest little birds of agricultural districts, and one of the typical members of the community that lives in the hedgerows and the gorse-strewn common lands It is a member of the finch tribe, and the cock bird, like most of its fellow finches, is both good-looking and melodious The song consists of a series of sweetly-twittered notes, not striking, but one of the pleasant minor songs which add to the general clamour in the springtime

The cock linnet (*Linota cannabina*) is very handsome for on his head as well as on his breast

he has a patch of red, while the light brown of his upper parts is a rich shade The nest of this bird is placed deep in the hedgerow, often in a thorn bush, or among thick brambles or gorse It is a small structure made of twigs and roots, lined with finer roots and hairs, and contains usually four or five bluish, red-spotted eggs Usually there are two broods in a season Other birds bearing the name linnet are the twite, or mountain linnet (*L flavirostris*), a brownish finch living in the moorland districts, and the greenfinch, often called the green linnet

Closely related to the linnets, and resembling them in their habits, are the redpolls, of which one, the lesser redpoll, *Acanthis linaria*, is now common in many parts of England This is a smaller bird than the linnet—indeed, the smallest of our members of the finch tribe, it is a rich red-brown above, pink on the breast, and white below It is known by its continual twittering, by the red crown which earns its name, and by its fondness during the winter months for the birches and similar trees, where it often consorts with other small birds in devouring such seeds and insects as it can find

Linoleum AND OILCLOTH Linoleum was introduced as a floor covering in England in 1860 by Frederick Walton, who coined the name and patented the modern process of manufacture It is made by mixing ground cork, oxidized linseed oil, various gums, and colouring matter, then pressing the mass on a backing of jute burlap It is hung in drying rooms to season for a period of one to six weeks, depending on the thickness and quality

Plain linoleum has no pattern and is in solid colours, or in two tones of one colour. Printed linoleum is made by stamping a design of oil paints on a thin kind of plain lino Inlaid linoleums, the most expensive kind, have the colour and pattern extending through to the burlap backing

Linoleum is often cemented down to keep it smooth and even, and to prevent moisture from getting under it If improperly laid it will buckle and crack Varnish on the printed linoleums, and wax on the inlaid and plain varieties, will preserve their life Strong soaps and cleaning powders are injurious

An inexpensive felt-base floor-covering which resembles printed linoleum has a base of paper or felt saturated with asphalt and finished with paint and a printed design

Oilcloth is made by coating coarse cloth with white lead mixed with pigments, then printing a pattern on the surface

The WONDER-MACHINES *of* PRINTING

A typewriter is a wonderful machine, but a typewriter that sets a line of type at once, casts it in metal, and then returns the individual "letters" back to their places—what a marvel that is!

Linotype. Of all the crafts that men practise, printing is one of the most intricate and complicated, and for that reason it was one of the latest to be mechanized From the time of Caxton up till some fifty years ago each and every letter, comma, and space in a page of printing like this one had to be "set up" separately by the fingers of the compositor

The linotype composing machine has effected a miraculous revolution in the business of type-setting, for the linotype itself is one of the most wonderful machines employed in the industry Instead of the compositor having to pick up the individual pieces of type, and set them up in words and lines in his composing "stick," the linotype operator strikes the keys on a keyboard something like that of a typewriter

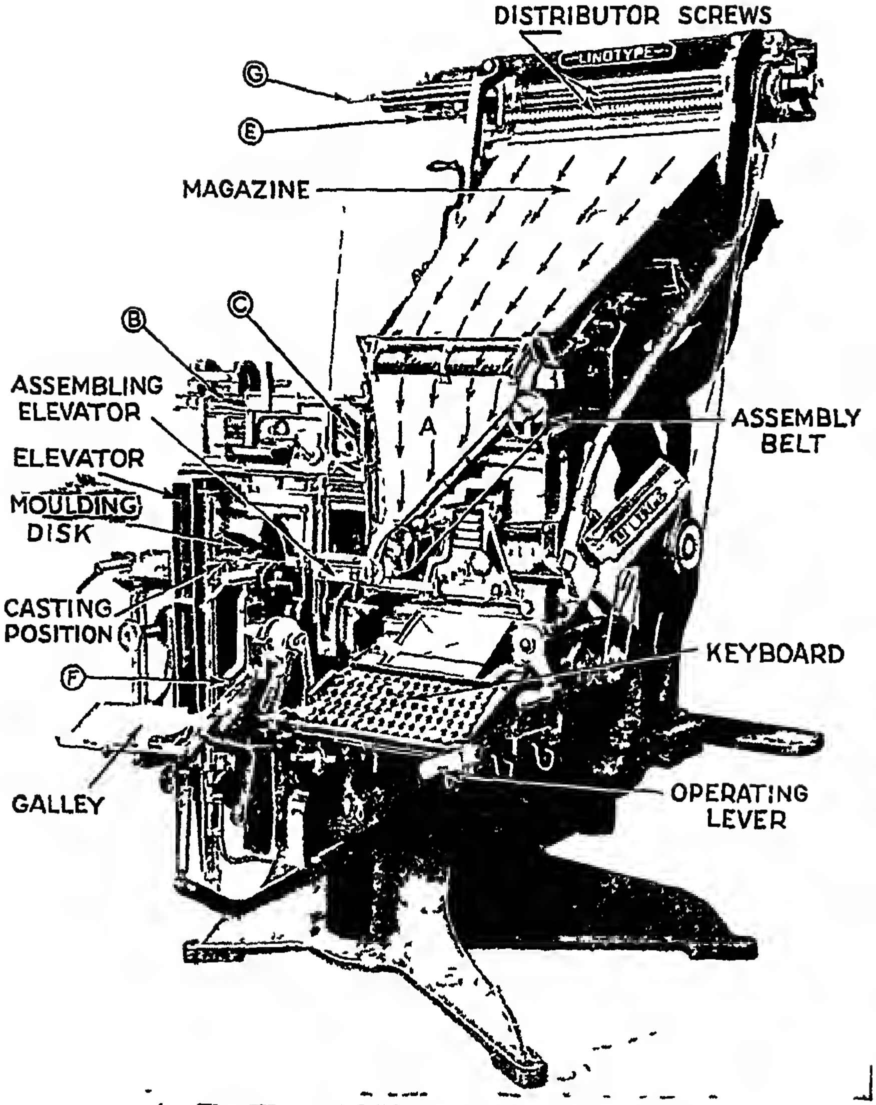
The adaptability of this wonderful machine is really astonishing Not only does it compose type in English, but by simply hooking on the appropriate magazine of "letters" it can be used for setting up type in all languages using the Roman alphabet, and also in Greek, Gothic and Hebrew characters Another model can set up type in the Arabic, Turkish, Persian, and Hindu languages

Some of the London daily newspaper offices have as many as forty or fifty of these machines in operation Many of the large provincial dailies are but little behind those of the metropolis in the number of linotypes in their equipment, or in the bright and airy rooms where the operators work The contrast between an up-to-date linotype room and the dirt and squalor of many of the old-time composing rooms is almost unbelievable

Linotypes are used all over the world On the Continent some of the newspapers employ women as linotype operators, while in India Goanese, Hindus, Parsees, and Mahomedans can be seen operating linotypes side by side

The honour of inventing the first model of the linotype belongs to Ottmar Mergenthaler (1854–1899), who was by trade a watch-maker, and who emigrated to the United States from Germany when he was eighteen years old

Naturally, the creation of a machine so complicated as this, and one so intricate in its action, was no easy task, and for years Mergenthaler had to contend with heart-breaking disappointments, but in 1886 he suceeded in making a composing machine which would work



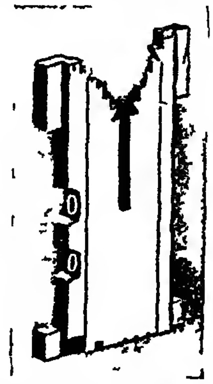
1 The Wonderful Mechanism of the Linotype

of the keyboard, a wonderfully delicate mechanism is brought into play which delivers the matrices in the proper sequence to the assembling belt through the channels A The matrices coming down from the magazine are combined with the spacing bars, or "spacebands," which are stored at C, and when the operator has assembled a full line of matrices and spacebands, he presses down with his right hand on the operating lever which raises the matrices slightly in the assembling elevator

The entire group of spacebands and matrices is then carried to the left to the casting position, the spacebands—which are wedge shaped—are struck from below to expand the line of characters to fill the full width of the line Molten type metal is then forced through a slot in the moulding disk against the matrices, and a line of type is cast

The water-cooled moulding disk turns partly round while the metal is solidifying, and the slug of still hot but now solid metal is forced past knives which trim it to the desired line The slug then continues out through the channel F and takes its place in the galley

2 Here we see a matrix containing two letter o's, one in roman type and the other in italic, so that either may be used at the choice of the operator Notice that the letters are hollow moulds, in these the type is cast



2 The Little Brass Matrix which Casts the Face of the Type

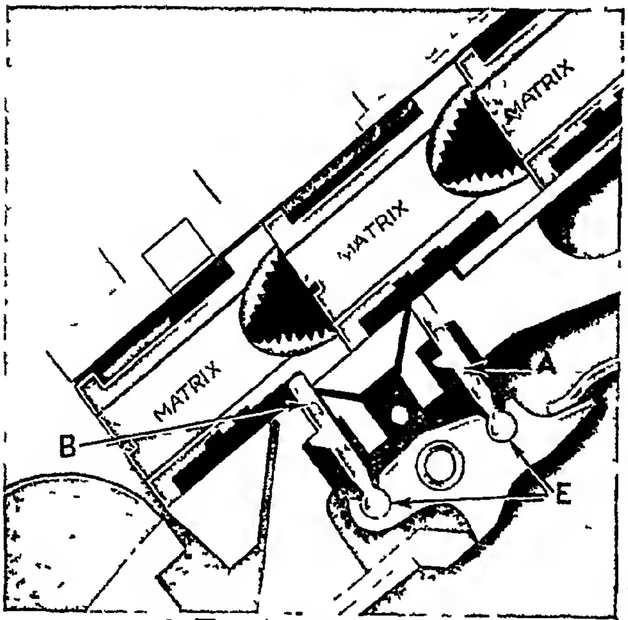
3 Now that we know what a matrix looks like, we shall be able to trace its path through the machine First we must understand the

In recent years innumerable improvements have been introduced, and today the linotype is admitted to be one of the most wonderful and indispensable machines ever invented, and one that has revolutionized the mechanical side of book, display and newspaper production The rate of composing is from 6,000 to 7,000 ens an hour (about 1,200 words)

The intertype machine is similar in general principles to the linotype, and, like it (but unlike the monotype), sets a solid line of type It has a special device for "justifying lines," *i e*, making them the same length, even if they do not contain the same number of letters or words (*See* Monotype)

1 The linotype, so called because it sets up a "line of type," is shown complete above In each of the magazines at the top are many hundred brass matrices, or moulds, with the faces of nearly a hundred different characters cut in them When the operator presses the keys

escapement which controls the dropping of the matrices on to the assembly belt In Fig 3 we see three matrices resting in their "channel" in the magazine The one at the left will drop first as it is released by the withdrawal of the pawl B,



3 How the Matrices Drop

brought into action by the pressing of the key for this channel Notice, however, that there are two pawls, the second one, A, being below the centre matrix, but not engaging it Through a swivel arrangement, both pawls connect to a rocking lever, or verge, at E, so that only one pawl at a time can project up into the channel

The verge is rocked back and forth *once* by an ingenious mechanism when the key is pressed, thus lowering pawl B but at the same time raising pawl A, which catches the second matrix before it can drop On returning to the position shown, the pawls let the matrix slide until it is caught by pawl B

Having pressed a key to start the matrix moving, let us follow it As soon as it is released, it slides through a channel out of the magazine and down on the assembly belt This is so cleverly arranged that, although there are nearly a hundred characters coming from different distances, they all take the same time to travel from the escape pawls to the assembly elevator This insures that the characters making up a word will come in the proper sequence at the assembly elevator

How Lines are Spaced

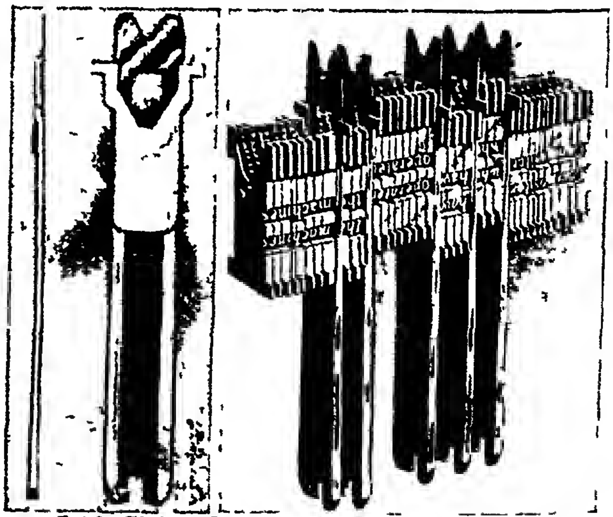
4 Now we come to one of the most ingenious parts of the entire machine—the automatic spacing or "justifying," of the lines In a line of type, we are allowed just so much space to fill—no more, and no less But our letter characters make up words of varying length, and there must be spaces between them These spaces must take up all the rest of the width of the line For many years this problem was a stumbling block for inventors It was finally solved in a very clever, yet surprisingly simple manner Let us refer back to Fig 1 You see that the spacebands are stored at the point C These spacebands are made of spring steel, and are in two parts One part is shaped a great deal like a matrix, but of course there is no mould cut in its face This part carries "gibs" or slide-ways, and the other part, which is wedge-shaped, slides up and down on it Being wider at the bottom than at the top, the wedge naturally takes up more space if it is forced up high between the matrices than if it were allowed to remain low

The operator fills the line in the assembly elevator with matrices and spacebands until he cannot get another full syllable in the remaining space He then depresses the operating lever, raising the elevator up until a projecting piece on it strikes a little tripping lever on the machine, which then takes up the work, performing the balance of the operations automatically, while the assembly elevator returns to the operating position to be filled with more characters

When the spacebands and matrices reach the casting position, a bar moves up from below and strikes the spacebands firmly, driving them up as far between the matrices as possible, thus automatically filling up all the remaining space just before the type metal is forced into the matrices

In Fig 4 we see a line of matrices spaced out with the wedge-shaped spacebands, and also how the matrices may be located to cast the italics If you turn this page upside down you can read the characters which will be cast

You would have believed yourself a clever inventor if you had thought that out, but it is only one of a hundred clever things in the linotype The inventor of the spaceband was an American, John R Rogers, who has to his credit not only more than



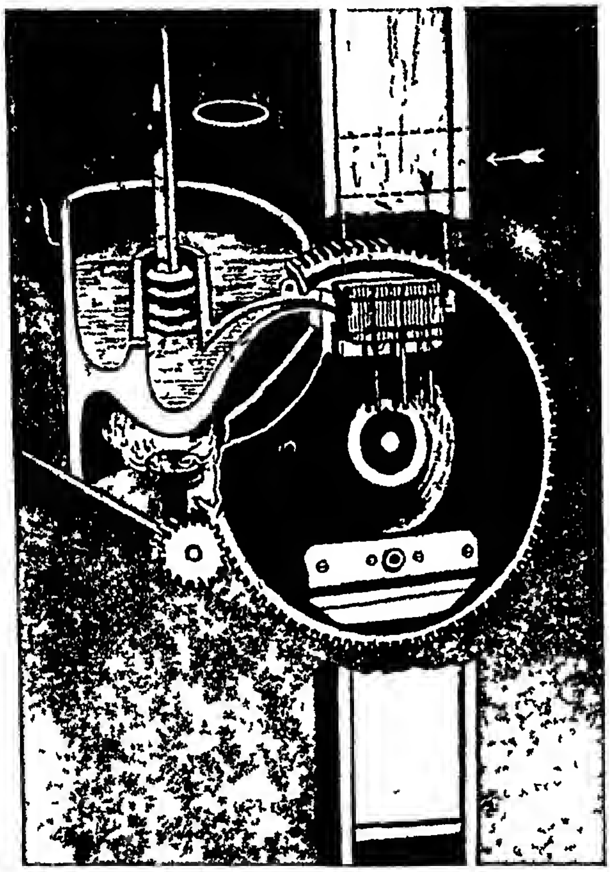
4 Little Sliding Wedges that Space Out the Words

400 inventions on the linotype, but who helped to make the radio-telephone a success

5 At the back of this wonderful machine, and in the very heart of it are found the moulding disk and the pot of molten type metal The modern moulding disks are cooled by circulating water,

and are provided with as many as four different moulding slots, which may be of different widths and thicknesses The operator can quickly set the machine to bring the required slot into position The type metal is kept liquid by electricity, and is automatically fed into the pot to keep it full

When the matrices and spacebands are in place before the slot, a plunger forces the type metal into contact with the matrices and fills the space



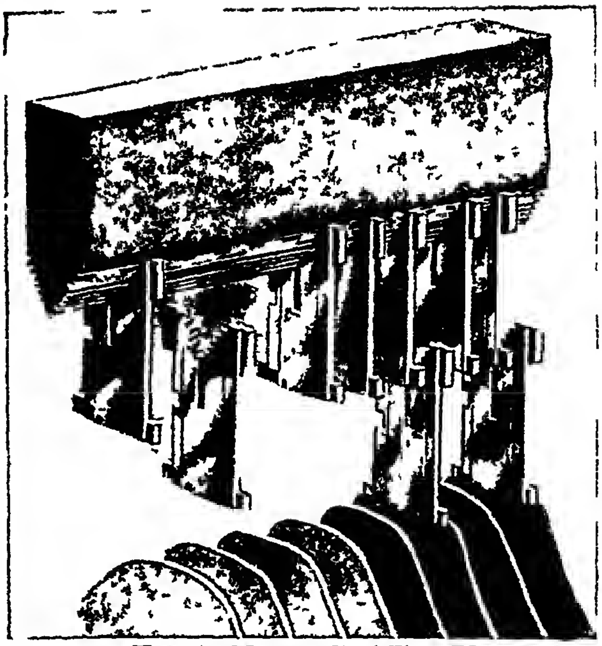
5 The Letters Arrive at the Casting Mould

behind, or within, the slot When this metal solidifies—a matter of seconds—the moulding disk revolves, the slug of metal is forced out and trimmed to proper height and thickness, and is then pushed out of the machine on a galley, where it is in line with the previously set type

Returning Matrices and Spacebands

6 Now we come to another wonderfully ingenious feature of the linotype We have done with the brass matrices, and the spacebands, and must get them home again But they go to different places, and we now have them together

After leaving the moulding disk the matrices and spacebands are carried upward by an elevator Then a long arm swings downward from beside the magazine, and picks up all the matrices at B (Fig 1), *but leaves the spacebands* The latter are pushed directly to the right and fall into their storage space C (Fig 1), while the long arm carries the matrices up to the side of the magazine Here a

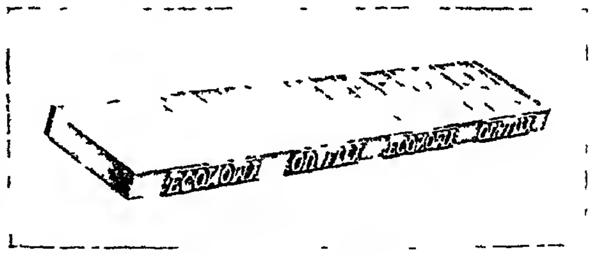


6 How the Matrices Find Their Way

pushing mechanism G (Fig 1), slides the matrices away from the pick up arm, and on to a peculiar track, Fig 6

Here the matrices are moved along by the revolving distributor screws shown in Fig 1 until each matrix comes directly over its proper storage channel in the magazine There, it drops automatically If you will note the illustration (Fig 2) of the matrix, you will see that the top is notched deeply in a Vee-shape Each different matrix has a separate combination of teeth projecting from the sides of this notch These teeth hook into certain ones of the many grooves in the distributing track and so support the matrix as it moves along But at the place in the track directly over the magazine channel where each matrix belongs, the particular combination of grooves that supports that matrix is cut away Thus, when the matrix reaches its proper place it simply drops off the track

7 This is the line of solid type or the slug as it leaves the moulding disk The letters on the matrices are cut *into* them and read like print On the slug, however, the letters are raised and



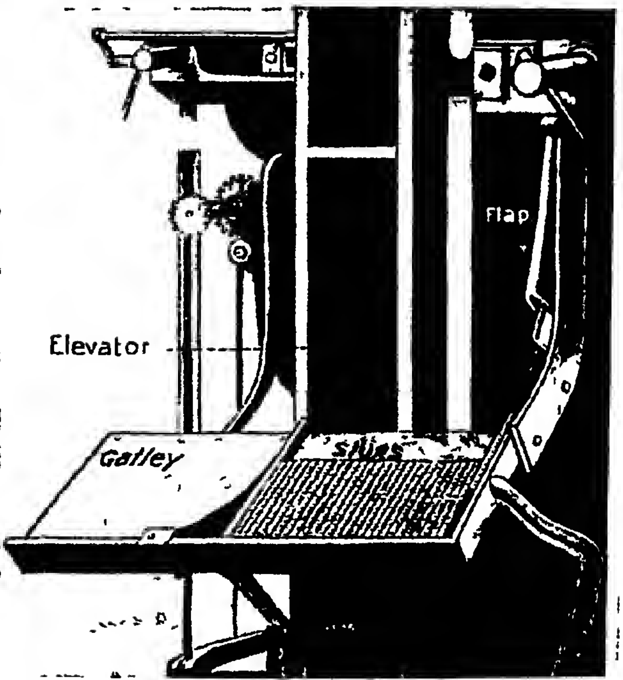
7 The Line of Type

read backward, in order to make them come right when printed If you hold this picture up to a mirror you can read the words that are cast on the slug The side ribs prevent one slug from sticking to the next one

8 One after another these slugs slide from the machine and form into columns that will presently march into print It seems a simple result to come from so complex a machine Yet it was to bring about this simple result quickly and accurately that Mergenthaler and others devoted years of effort Even now a new generation of inventors is at work to improve the linotype and add to its performance Now we have linotypes with as many as three main magazines at the top instead of one, and with two complete alphabets in each Then there may be three auxiliary magazines that carry one alphabet each of big display type-faces, so that a single machine may have a total of six magazines with nine alphabetical sets in different sorts of type, with a total of 642 separate characters all worked from one keyboard

By the use of different "founts" of matrices and different sizes of moulding slots, slugs may be cast with a body size from 5 point to 36 point (½ inch) and up to 5 inches in length, and in some machines up to 7 inches in length, with letters from 5 to 60 points (⅝ inch) high

Fifty-six operations go into the making of a matrix The letter is designed, traced on a brass plate which serves the master pattern, and a pantograph device following the pattern cuts the character on a steel punch which cuts the matrix



8. The Lines of Type Grow into Columns

MONARCH *of the* ANIMAL WORLD

That a cat should be considered "king of the beasts" is a strange thing, yet that the lion is a kind of cat in its habits, though not in its appearance, will be seen from what is said in the article that follows

Lion. Can you believe that your cat—that soft, gentle, playful, purring pet—belongs to the same family of animals as the majestic lion, which many centuries ago was given the title "the king of beasts"? However strange it may seem, this is the case, and, as a matter of fact, they are very much alike indeed, except in size and, perhaps, in colour Of course, there are other differences of minor importance Thus, the pupil of the cat's eye is elliptical, that of the lion is round The cat is a good tree-climber, while the lion does not normally climb trees The cat's fur is of nearly an equal length all over its body, while the male lion possesses a mane which, when at its best, covers the fore-part of its body, including the head, and gives it a truly royal look

In ancient times the lion (*Felis leo*) inhabited the whole of Africa, all the southern part of Asia, and a large part of south-eastern Europe It is still found in many parts of Africa and Asia, though in greatly reduced numbers

A large lion measures from nine to ten feet in length, including the tail, and is four feet high It is not so large as the largest tigers, some of which attain eleven feet in length and weigh from 450 to 500 lb But the strength of the lion is prodigious With a single blow of its massive forepaw it can crush the skull of an ox or break the back of a horse, and it is capable of carrying off a bullock in its jaws A comparison of the lion's build with that of the tiger shows this creature to be a sprinter and sudden jumper, a beast of the open For it has huge fore-quarters and small hind-quarters, giving tremendous power for pulling down prey in the open by sheer weight The tiger, however, is more symmetrical, and better adapted to life in the dense jungle The lion can cover thirty feet at a single bound, and few animals other than antelopes can outrun it over short distances Its tawny colour blends readily with its natural surroundings making it almost invisible at a little distance

Authorities disagree in regard to the hunting habits of lions It seems probable that as a

THE MAJESTIC LION ON THE ALERT & AT PLAY

That the greatest of beasts can be perfectly at home in a modern zoo is shown by these fine photographs of lions, both of which were taken in such situations. The upper picture shows two zoo lion cubs, Max and Climax, having a game with their father, while the lower was taken at the Zoo's open air establishment at Whipsnade. In this English 'jungle' these great cats seem quite at home, though they are obviously ready to spring into action at any suspicious sight or sound

Photos: top, Daily Mail; bottom, Sport & General

rule they live and hunt singly, except during the mating season and while the young are half-grown, when the whole family unites in the chase Travellers in South Africa report that lions are sometimes seen hunting in packs of from six to ten These packs may be composed of two or more female lions and their cubs

In common with most members of the cat family, the lion prefers to hunt at night, setting forth at sunset and lying in wait for its prey at a watering place, or stalking stealthily, in true cat-like fashion, keeping always to the leeward and cleverly taking advantage of every bit of cover until it is within striking distance Then it utters its terrifying roar and leaps upon its victim, which it dispatches by biting the neck

Man-eating lions are not common It is said that usually they are very old lions, too slow to catch the lively antelopes or zebras which formed their prey when young, and that, like the tiger, when once they taste human blood they persist in the habit as long as they live Man-eating lions have been known to enter the native villages and carry off a man or a woman in their jaws, in spite of fires and shouts and beating drums The story is well known of the two lions which killed so many native workmen that for weeks they stopped the building of the Uganda railway

The young of the lion, generally only two in a litter, are born in a den in some secluded spot selected by the mother lion, who guards them jealously and does not permit even the male lion to approach Like the tom-cat, the lion is inclined to make a meal of his offspring The mane begins to grow on the young male during its third year, but it does not attain its full growth until the seventh or eighth year Lions live from forty to fifty years They are easily kept in captivity and even breed quite freely Crosses of the lion with the tiger—either "tigon" or "liger"—have also been obtained In America the puma is called the "mountain lion" (*See also* Cat)

Androcles' Adventures with the Lion

EARLY one morning, in the 1st century A D, a weary man came to a cave in an African desert, and, flinging himself on the ground, fell into a sound sleep This poor man was a Roman slave named Androcles, who had been carried from Rome to northern Africa His master was very cruel, and he had for long watched his chance to make his escape

Androcles removing the thorn from the lion's paw, from the painting by Briton Riviere, R A
National Collection New Zealand

Suddenly he was awakened by a terrible roar, and starting up, he beheld a huge lion standing at the entrance to the cave He had been sleeping in the lion's den There was no way of escape, the beast barred the way Terror-stricken, he waited for it to spring upon him and tear him to pieces But the lion did not move It stood there moaning and licking one of its paws Then Androcles noticed that the paw was pierced by a great thorn and that blood was flowing from the wound Seeing the poor animal in pain, he forgot his fear, and, taking the paw in his hand, drew out the thorn and stopped the blood

For three years Androcles and the grateful lion lived together in the cave They hunted together, ate together, and slept together

But Androcles longed to be once more among his fellow-men, and he left the lion's cave Very soon he was caught by some soldiers and sent to Rome In those days the Romans were very cruel to runaway slaves, they ordered them to be thrown into the arena to fight wild beasts for the public amusement

Androcles was pushed into the arena, which was surrounded by crowds of people A lance was thrust into his hand, and he was told to

defend himself against a powerful lion, which had been kept without food for several days in order to make it more ferocious

Androcles shook with fear as the cage was opened and the lion sprang out with a terrible roar But instead of rushing upon him, it showed itself friendly and began to lick his hands Then he saw it was the very lion that had been his companion in the cave Androcles leaned against the lion's mane and wept

All the people marvelled at this strange sight The emperor sent for Androcles, and when he heard his story he set him free and presented him with a large sum of money After that, whenever Androcles walked through the streets of Rome, and wherever else he wandered, the faithful lion always followed him about like a dog At least, so the story goes!

Liquid Air. If you had some liquid air in a container it would look much like water, only it would not be so clear But it would act very differently from water If you poured it on a block of ice it would boil vigorously, sending off clouds of vapour A steel watch-spring dropped into it and touched with a lighted match would burn beautifully, with a dazzling shower of sparks A piece of rubber when dipped into it would become as brittle as glass, and an egg would appear as a shining blue ball

Just as water passes into steam at its boiling-point, 212° F, and becomes solid ice when the thermometer falls below 32° F, so all other matter changes by the addition or subtraction of heat Even iron becomes liquid and then passes into heavy vapour fumes when the temperature reaches a certain high point Air is made liquid by lowering its temperature under pressure to 312° below zero (Fahrenheit), a cold so intense that we could not survive an instant in it Although it is then a liquid it is not wet, any more than molten iron is wet At a lower temperature still, liquid air changes to a solid

How Liquid Air Splits Up

It was discovered in 1894 that when air becomes liquid it resolves itself into the elements that compose it, oxygen and nitrogen The carbon dioxide present early crystallizes as a solid, giving the liquid its cloudy appearance, and it can easily be filtered out Liquid nitrogen evaporates more easily than liquid oxygen, and so it comes off first Thus as the liquid air evaporates it becomes richer in oxygen

Practical use is made of liquid air to manufacture oxygen from the atmosphere, to obtain nitrogen for fertilizing purposes, and as a refrigerating agent It can also be used as an explosive, as it exerts a pressure during evaporation of something like 10,000 lb to the square inch As an explosive, however, it is hard to control

Liquorice. The liquorice drops and sticks and slender "whips" which are found in every confectionery shop are made from the juices of a member of the pea tribe, *Glycyrrhiza glabra* They are obtained from the long pliant roots which extend straight down into the ground for more than a yard The plant is cultivated in the warmer parts of the Old World, especially Turkey, Russia, Italy, Iraq, India, and Spain, and has long been known and valued The generic name *Glycyrrhiza* is a Greek word meaning "sweet-root"

Stick liquorice is made by straining and concentrating the solution obtained by boiling the crushed roots Mixed with sugar it is made into cough-drops, syrups and sweetmeats, and it is used to disguise nasty medicines

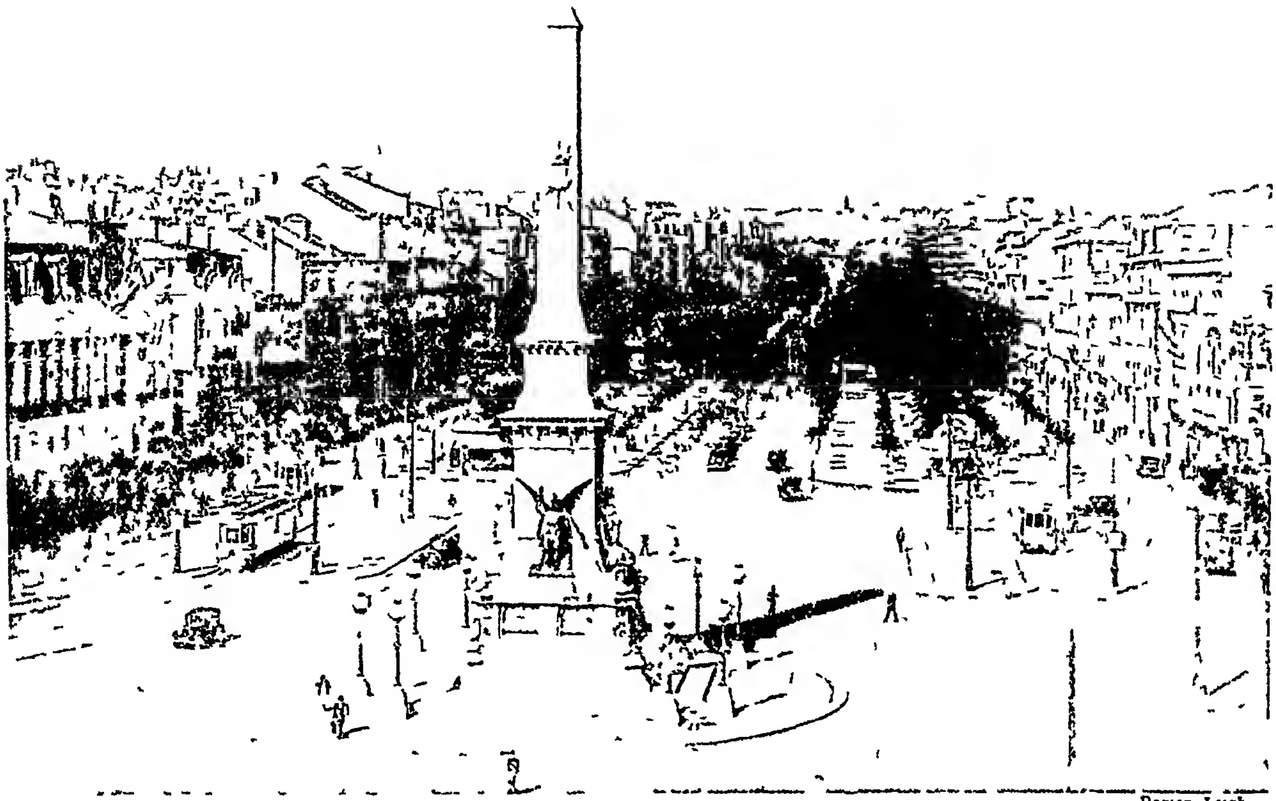
Lisbon, PORTUGAL Seven miles from the Atlantic, up the wide, swift channel of the river Tagus, lies Lisbon, the capital of Portugal and most western seaport of continental Europe The approach from the sea is like a trip up the neck of a great bottle, for immediately above the city the river broadens out into a tidal lake, 4 to 8 miles wide and 11 miles long, forming one of the best harbours in the world The wharves and quays stretch along the northern banks of the river and lake for five miles Beyond them the city itself rises in terrace upon terrace of white houses and green parks, backed by the granite mountains of Cintra

Lisbon is almost entirely a modern city, for the earthquake of 1755, which killed more than 30,000 of its inhabitants, left only a small section of the town standing This section contains, however, many interesting relics of ancient days Here in the cathedral, first built in 1150, is the tomb of St Vincent, patron saint of Lisbon, and in the cathedral grounds near by are kept a pair of ravens, popularly believed to be descendants of the birds which, according to legend, guided the saint's vessel to the city in the 3rd century

The modern part of Lisbon is not surpassed in beauty by any European capital The streets are straight and broad, the finest of all being the Avenue of Liberty, a mile long and 300 feet wide, with a double row of shady trees down the middle, its name commemorates the freeing of Portugal from Spain in 1640 Between the terraced levels of the city lifts carry people up and down Lisbon also boasts one of the finest botanical gardens in Europe

Lisbon crowds are always picturesque Barefooted fish-wives with coloured shawls, balancing trays of fish on their heads, and farmers with sombreros and brilliant sashes, mingle with the fashionable crowds in good-natured fellowship, and the milkman drives his cows through the city, morning and evening

The industries of Lisbon include distilling, dyeing, the manufacture of silk, linen, wool, and



SPLENDID BOULEVARD IN PORTUGAL'S CAPITAL

One of the finest streets of Lisbon is the broad Avenida da Liberdade, seen above, which runs through the heart of the city It is a mile long and is lined by handsome stone houses, while islands planted with palms and Judas-trees divide it into three carriage-ways A monument stands at either end of it That in the foreground commemorates Portugal's emancipation from Spanish rule in 1640, while that at the farther end commemorates the Marquis of Pombal, an enlightened 18th-century statesman

cotton cloths, pottery, soap, paper, chemicals, cement and cork, and canning foods It is a busy railway centre, and its fisheries are exceptionally profitable Population, about 594,000

Lisbon was probably founded by the Phoenicians, for it was a flourishing town before the Romans occupied it It was held by the Moors from 711 to 1147 Vasco da Gama set sail from Lisbon on his voyage round Africa in 1497, and it was from here that the Spanish Armada started on its ill-fated voyage in 1588, while the city was in the hands of Spain Lisbon was the chief scene of the Revolution of 1910 when the crews of revolting warships shelled the palace, and King Manoel was driven from Portugal and the republic established

Lisle, Claude-Joseph Rouget de (1760–1836) The most stirring and the most famous national song in the world, the French "Marseillaise," was composed, both words and music, in an hour by Rouget de Lisle, while sitting alone in his lodging, with his violin beside him

The song proved to be the greatest inspiring force in the French Revolution, and has since become the national anthem of the Republic De Lisle was born at Lons-le-Saunier, Jura, May 10, 1760 As a young man he was fond of music and the drama, and was in a humble way a poet and a novelist While a captain of engineers in the Army, he was in Strasbourg at a banquet given by the mayor on April 25, 1792, a few days after war had been declared by France against Prussia and Austria

Something was said about the need for a national patriotic song, and in a state of excitement de Lisle went home and composed the "Marseillaise," or, as he first entitled it, "Le Chant de Guerre de l'Armée du Rhin" The volunteers from Marseilles first made the song with its rousing air their own, and it was not until they reached Paris that it electrified the capital and became known as the "Marseillaise" De Lisle had a stormy life, and he was an old man before he was freed from the haunting shadow of poverty by receiving a State pension and the cross of the Legion of Honour He died at Choisy-le-Roi, June 27, 1836

Lister, Joseph, 1st Baron (1827–1912) Few men have been privileged to confer such great benefits on suffering humanity as did Lord Lister by his discovery of antiseptic surgery Before his day a serious operation meant almost certain death, because almost invariably putrefaction, gangrene, and blood-poisoning occurred in the wound made by the surgeon's knife

When, in 1862, Pasteur announced his theory of fermentation and putrefaction, Lister was quick enough to apply the new theory to surgery In 1866 he made the epoch-making

discovery that the surgical evils of his time were wholly the result of germs, and that by the use of carbolic acid the wound could be kept antiseptic and proof against the action of germs He also carried out important researches on materials for absorbent ligatures, drainage of wounds, and antiseptic dressings But for the general use of antiseptics in surgery which followed Lister's discovery, most of the operations that are now common practice in our hospitals could not be attempted at all When the Glasgow Royal Infirmary was being rebuilt, the old wards in which Lister operated, and in which he first put into practice antiseptic surgery, were retained as a fitting memorial to this great benefactor of mankind

Joseph Lister was born at Upton, Essex, April 5, 1827, and was most of his life engaged as a professor of surgery and lecturer at Edinburgh and Glasgow Universities, and later at King's College, London He was made a baronet in 1883 and was raised to the peerage in 1897 In 1902 he was made an original member of the Order of Merit He died February 10, 1912

Liszt, Franz (1811–1886) The flickering lights of a gipsy camp-fire fall with softening glow over the gaudy garments and dark, passionate faces of a group of singers gathered about it Slightly apart in the shadow sits a pale, dreamy faced stranger listening The fire burns low, and the song with its mournful lament, its glad, mad gaiety and plaintive wistfulness, dies away, but still the stranger sits, transfixed and silent in the darkness

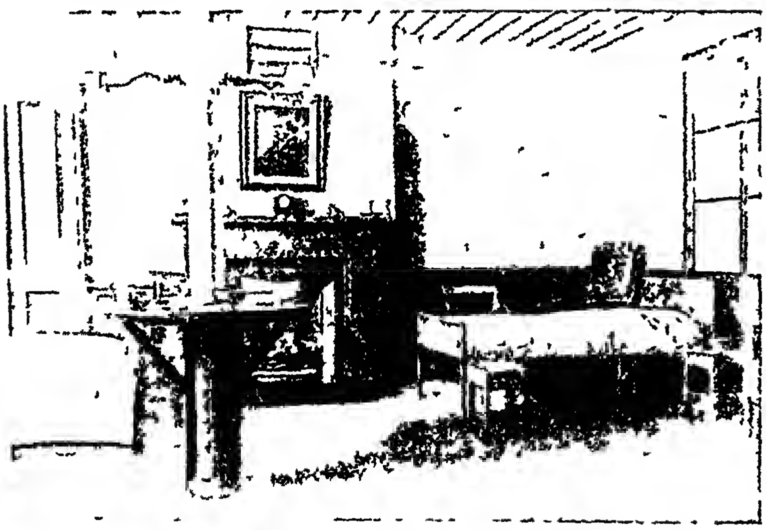
It was the great musician, Franz Liszt, and that night by the gipsy camp-fire there were born in his soul the strains that later were to leap forth at the touch of his fingers upon the piano keys in the "Hungarian Rhapsodies"

This "Hungarian wonder child," as Liszt was called, began his public career at the age of nine His father, an accomplished musician, taught him the theory of music and to play the piano But the strange rhythms and weird sweet melodies of his compositions he owed to the wandering gipsy bands of his childhood home

As a little boy Liszt showed such musical genius that Hungarian noblemen furnished the money for his parents to take him to Vienna and give him the best musical instruction At the age of 12 his playing so moved the great Beethoven that, dropping his customary reserve, he took the child in his arms and kissed him At 14 years of age Liszt composed a successful operetta

Liszt's life was a long series of artistic triumphs As a concert pianist he has, perhaps, never been excelled It is said that he showed the world how to perform feats in piano playing which before his time had been considered impossible His compositions include works for the piano, organ, orchestra, and voice He became a great teacher, counting among his pupils many of the greatest musicians of the 19th century He became director of music to the Grand Duke at Weimar (Germany) and was decorated by every court of Europe In 1861 he retired from public life to Rome, and later joined the Franciscan order

The kindness and generosity of the "Abbé" Liszt have become proverbial, as also has his appreciation for struggling young artists Among many whom he befriended were Chopin, Berlioz, Schumann, and Wagner He died July 31, 1886 (in which year he paid a last visit to England), at Bayreuth, where he had superintended the productions of Wagner's operas



LISTER AND HIS HOSPITAL WARD

Lord Lister, whose photograph appears above, made one of the most valuable of all contributions to medical science by his work in perfecting the technique of antiseptic surgery The lower photograph shows a section of a reconstruction of one of the wards in Glasgow Royal Infirmary where, between 1861 and 1869, Lister did much of his more important work in antiseptic surgery

Upper photo Elliott & Fry lower courtesy of Wellcome Historical Medical Museum

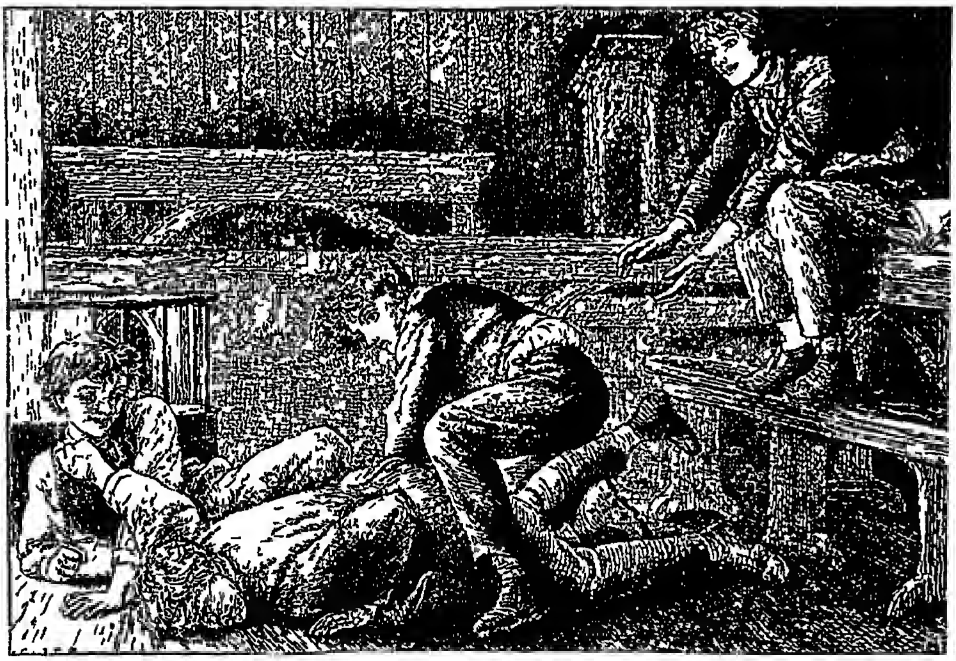
DOORS *that* LEAD *to* WONDERLAND

If sometimes you ask yourself the question What shall I read?—turn to these pages for the answer

Literature, CHILDREN'S Books resemble doors which we can open at will Through them one can pass out of the little house of his own knowledge and interests into a bigger world of things people are thinking or doing now, or of beautiful imaginings and beliefs, and brave deeds and daring adventures of olden times

It is well to have pride in choosing our books, just as we have in choosing our friends We do not like to think of ourselves as always associating with persons ignorant and coarse, and careless in speech and manners Still less do we desire friendship with the really bad Constantly reading silly or poorly-written books, or books that make evil things seem right, will have precisely the same effect on one's character and manners as being always with the wrong sort of people Choosing the best books will lead us into the society of the world's greatest minds, and make us capable of enjoying that society

It is not at all necessary to be afraid of the books called great Much of the best of literature is most interesting to the younger folk, and what is equally true is that the best literature is the most easily readable Some of the famous classics are old tales grandmothers used to tell boys and girls long ago—rhymes to tickle their ears, like Mother Goose, pleasant poems and songs, fables about animals, tales of the elves and goblins thought to inhabit wood and mountain, stories of the gods of earth and sky that ancient peoples believed in Other books contain songs and tales that travelling musicians and story-tellers told about brave heroes Some very famous books, such as "Robinson Crusoe" (*see* page 1188) and Jonathan Swift's "Gulliver's Travels," were not written for children at all, yet children have claimed them for their own Kingsley's charming story, "The Water-Babies" (*see* the outline given in page 2387), was written in part, at least, to expose the hardships to which chimney-sweeps were



TOM BROWN DEFEATS THE BULLY

After Tom (in "Tom Brown's Schooldays") had been "roasted" by the bully Flashman, he and his friend East decided to "lick" him, and in hall one evening, while Diggs, an older boy, acted as referee, they set about Flashman By means of an old wrestling throw, Tom brought him down with a crash, as shown here The bully never attacked them again after that

Illustration by Arthur Hughes to an edition of 1890 courtesy of Macmillan & Co

exposed, but it is still read when those evils have long been abolished

Whatever one's taste, there are good books to satisfy it One of the most fascinating book-paths is through the land of fairy and folk tale Hans Christian Andersen and the Grimm brothers are guides thither, and the "Arabian Nights" is itself a magic carpet to transport the reader to the mystic Orient

Another beautiful region into which some of the greatest books lead is that of mythology These tales carry one to Mount Olympus in ancient Greece, where dwelt Zeus, king of the gods, Apollo, god of light and music, and Aphrodite, goddess of love and beauty We have many interesting examples of them in "The Heroes," by Charles Kingsley Others take one to the northland, where, in the flickering of northern lights and the thunder-sounds of storm, the old Norsemen saw the Valkyrie riding, and heard the hammer of Thor, the Thunderer We can read of these in "Popular Tales from the Norse," by Sir George Dasent

Every land has had its early heroes, and great poems and story cycles have grown up about them At first a boy or girl cannot easily read the whole poems, even in translation, but most of them have been put into a form more easily understood The travels of Odysseus, the wise hero of the Greeks, the wanderings of Aeneas, the deeds of Beowulf, the prowess of Roland or of King Arthur—these are a few of the hero-tales Great heroes appear in the Bible stories, also

There are plenty of good stories, too, about boys and girls of a later day—such books as "Tom Brown's Schooldays," "Kim," "The Jungle Book," and "The Adventures of Huckleberry Finn," or, amongst those by living authors, Arthur Ransome's "Peter Duck" and "Swallows and Amazons," and Erich Kastner's "Emil and the Detectives"

The field of the novel and short story is one that widens as the reader grows older, and exploring it brings both fun and profit Many entertaining novels and stories have a valuable background of history Facts closely packed in school histories sometimes seem dry, but when we supplement them with stories like "Kenilworth" or "Westward Ho!" or "The Last Days of Pompeii" they have new meaning

EMIL AND THE DETECTIVES TRAIL THE CRIMINAL

On a visit to his grandmother in Berlin, Emil is robbed of his money by a mysterious "man in a bowler hat" But the stranger is soon discovered by a band of child-detectives whose aid Emil enlists, and the man in the bowler hat is finally pursued through the streets by an ever-growing crowd of boys, led by "The Flying Stag" on his scooter Above is this scene from the German UFA film of Erich Kastner's delightful story

One of the most interesting things in the world is the life-story of some great man or woman Everyone likes a story with a hero who accomplishes something in the face of difficulties, and every great person is such a hero Whether it be Napoleon or Joan of Arc, Florence Nightingale or Robert Louis Stevenson, the biography is inspiring

Reading of the deeds of such people, and of their human side—letters they wrote to their friends, things they said and did in private life—actually seems to admit the reader to intimate friendship with the great The reason why

Boswell became famous is that he wrote a long book that brings us very close to a great man—his "Life of Dr Samuel Johnson"

Most boys and girls love poetry for its rhythm and beautiful words when their mothers recite children's verses to them Yet certain older ones think they do not care for poetry Even these, however, will find plenty of action and story interest in "The Lady of the Lake," "The Ancient Mariner," or some of the old ballads When Sir Walter Scott was a boy he was entranced by Percy's "Reliques of Ancient English Poetry," in which there are many fine old ballads Sir Walter's own "Minstrelsy of the Scottish Border" has also many stirring ballads The same qualities of simplicity and action are to be found in Macaulay's "Lays of Ancient Rome" And besides action they will find rhythm and beauty and fitness of language that will open up a whole new world of seeing and feeling, a world the person who "doesn't care for poetry" shuts himself out of Nature poems like Shelley's "Cloud" or Wordsworth's "My Heart Leaps Up" make us see Nature with new eyes You will also find much to please and delight you in "A Child's Garden of Verses," by Robert Louis Stevenson

And then the plays—Shakespeare, of course After reading Charles and Mary Lamb's "Tales from Shakespeare" one is ready for the plays themselves, and the finest of reading they are, with their vivid action and wonderful pictures of Nature

In choosing books to read it helps, of course, to seek advice from some older person who knows a good deal about them The librarian at the local library should also be consulted, and the man behind the counter in the book-shop may also be very helpful

Another good plan is to get a list of the "classics" published by such firms as the Oxford University Press, Dent's, or Collins You may be sure that every book in the list is a good book, one worth reading, although some of them will be too "old," no doubt, for you at first

Then don't be content with *borrowing* books from your friends or the library Buy them for yourself, and so build up a library of your own Maybe you cannot afford many new books—though good books were never so cheap as now, when for a shilling or two you can buy a friend for life (that's what a good book may be) If this be the case, then haunt the second-hand bookstalls and -shops Wonderful bargains are to be picked up in every town, and a really fine collection of books may be made by spending a few coppers each week

STRUWWELPETER

One of the most famous of children's books is "Struwwelpeter," or, as it is called in English, "Shock-headed Peter" It was first published in Germany in 1847, and has been translated into nearly every European language Above is a page from the book, by Heinrich Hoffmann

Courtesy of Blackie & Son Ltd

Now let us take a dip into history, and learn something of the development of children's literature during the last few hundred years

The first story-books designed for children's entertainment were published in England in the middle of the 18th century by John Newbery Oliver Goldsmith is believed to have been the author of the most famous of them, "The History of Goody Two-Shoes" (1765) In "The Vicar of Wakefield," Goldsmith describes the genial publisher of these gay little books, bound in "flowery and gilt" Dutch paper, as "the philanthropic bookseller of St Paul's Churchyard" Newbery published the first collection of Mother Goose rhymes about 1760, under the title "Mother Goose's Melody"

Myths and fairy tales, poetry and song, are the bed-rock of literature The first book of fairy tales written and published for children appeared in France in 1697, under the title "Contes de ma Mère l'Oye" ("Tales of My Mother Goose") Charles Perrault, a member of the French Academy and a friend of La Fontaine, retold some of the fairy tales then so popular at the court of Louis XIV, for his own little son, who made a book for other children "Cinderella," "Bluebeard," and "Puss-in-Boots" proved as fascinating to English-speaking children as to the French when they were translated 30 years later

John Locke, the famous philosopher, had a plan which called for teaching children the alphabet and many other things by playing games. He considered "Aesop's Fables" the best book to put into a child's hands, and recommended choosing one with pictures in it.

Later in the 18th century came Rousseau with another plan, embodying some of the same features with others entirely his own. Rousseau had great enthusiasm, and the book he wrote, "Émile" (1762), is more readable than Locke's "Thoughts on Education" because it is written about a boy called Émile who has a tutor and spends his boyhood out of doors. Émile is allowed no books at all to read until he is 12, and then he is given "Robinson Crusoe" and is supposed to relive Crusoe's experience.

To Rousseau, and to those who believed in his theories, Émile represented "the natural boy." Considerably more than a century later, Mark Twain provided a living natural boy who has since passed from the Mississippi River country to many lands. Huckleberry Finn bears very little relation to Émile, except that he shows how different a boy can be when he is drawn from life from when he is made to fit into a theory.

Thomas Day's "Sandford and Merton" (1783) is a landmark among children's books with a purpose. Day took his theory largely from Rousseau, but the life of his child characters was derived from Henry Brooke (c 1703–1783), a writer with a gift of humour and a sympathy with childhood far ahead of his time.

To this period also belongs Mrs Trimmer's "The Story of the Robins." Originally published as "Fabulous Histories," it represents one of the first attempts to instil in the minds of children kindness to birds and animals. Mrs Trimmer was also among those who made liberal use of pictures to interest children in historical subjects, and certain pictorial charts and maps of the present day reflect the influence of her work.

But of all who wrote under Rousseau's impetus to child study, Maria Edgeworth stands out as the best story-teller. Her "Parents' Assistant" is not a treatise, but a genuine story-book which has been reprinted again and again since it was first published in 1796. Many of her stories are as good today as they ever were, for in writing for children she never failed to supply plenty of incident and clearly-defined character and plot. Several of her stories, with an illuminating introduction by E V Lucas, are included in his "Old-Fashioned Tales." This volume includes also a selection from "Holiday House," by Catherine Sinclair—"the first children's book," says Mr Lucas, "in which the modern spirit manifests itself." A comic giant appears in the story—"a giant so tall that he was obliged to climb up a ladder to comb his own hair"—a giant who is the forerunner of a glorious company of fun-makers such as Dr Heinrich Hoffmann with "Struwwelpeter" (Shock-headed Peter), Edward Lear with his "Book of Nonsense," and Frank R Stockton with his entertaining stories of giants, wizards, and griffins.

HANS ANDERSEN'S TIN SOLDIER

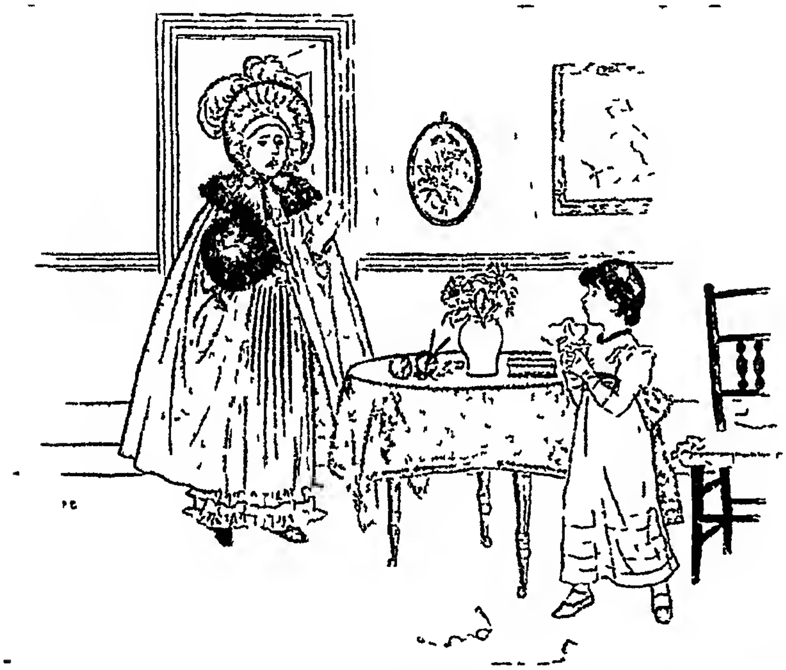
In Hans Andersen's story, "The Constant Tin Soldier," a tin soldier is put by two boys into a paper boat. He floats down a gutter, falls into a canal, is swallowed by a fish, and finally perishes in a stove. Yet he is constant until the end to a little lady made of pasteboard

Courtesy of Oxford University Press

Before giants could appear as comic figures, they had to become naturalized in familiar folk-tales. The book which more than any other contributed to this end and to the shaping of a new literature for children of the 19th century was "Kinder- und Hausmärchen" (Children's and Household Stories), by the Brothers Grimm, published in Germany in 1812. The two brothers who collected and wrote down these stories in many different dialects were scholars. Jakob, the elder, knew more about the history of words than any man of his day. Fully aware of the value of folktales as records of social life and of primitive beliefs, they devoted 13 years to transcribing their stories without changing a word.

Hans Christian Andersen put the stamp of originality on his fairy tales Even the traditional stories of Scandinavia are always retold in his own manner, but the unique achievement of his invention is the wonder story, of which "The Constant Tin Soldier" and "The Nightingale" are typical If Andersen was not the first to give life and personality to inanimate objects, it is he who remains the master artist in this special field The stories were published a few at a time between 1835 and 1872

It is in William Blake's "Songs of Innocence," published in 1789, and in Wordsworth's "Lyrical Ballads," published in 1798, that the beginnings of poetry for children and the first clear recognition of childhood as a distinct element in human life are to be found



FROM A VICTORIAN CHILDREN'S BOOK

A famous illustrator of children's books in Victorian days was Kate Greenaway, who in her drawings set a fashion for children's clothes This example of her work illustrates the incident in the verses of "Meddlesome Matty," by Jane and Ann Taylor, when Matty opened her grandmother's snuff-box and sneezed so much that she broke the old lady's spectacles, which she had also put on

Courtesy of Frederick Warne & Co

Having once discovered the "new continent of childhood in the spiritual world," poets and story-writers have been in communication with it ever since Out of their combined efforts there has grown a special literature, prose and poetry alike, created for sheer joy of companionship with children—with birds and animals, earth and sky, sea and mountains and plain, as they appear to children

This special literature is still a part of the general stream To it belong Wordsworth's "Alice Fell" and "Lucy Gray," "The Little Black Boy" and "The Lamb" of William Blake, Christina Rossetti's "Sing-Song," Lewis Carroll's "Alice in Wonderland," Stevenson's "Child's Garden of Verses," the verses in Kipling's "Jungle Book" and "Just-so Stories," Alice Meynell's penetrating glimpses of children's life, W H Hudson's "A Little Boy Lost," and Walter de la Mare's "Songs of Childhood" and his unique anthology, "Come Hither," with its introductory essay and notes

Anthologies designed purely to give children and young people a share in a variety of genuine poetry have been in process of making and remaking since the appearance of "The Golden Treasury of Songs and Lyrics," selected by F T Palgrave and published in England in 1861, the "Children's Garland from the Best Poets," made by Coventry Patmore and published a year later, and "The Blue Poetry Book," chosen by Andrew Lang, with its generous selection from the old ballads

The first retelling of a classic to achieve a distinctive place in literature for children is "Tales from Shakespeare" by Charles and Mary Lamb The stories of 20 plays are included in the collection published in 1807 in two small volumes Charles wrote the tragedies, Mary the comedies

Mary Lamb, as revealed by her letters and in "Mrs Leicester's School," has a singularly clear and charming style These stories, autobiographical in form, are told by the children of a girls' school They embody many childhood memories of the Lambs, and are now more often associated with the literature of childhood than with literature read by children "The Adventures of Ulysses," published in 1808, was the work of Charles Lamb alone It is a landmark among classics retold, but it is not as much read today as the "Tales from Shakespeare" There have been many translations from Homer since then, and the best of them, such as the prose of Lang, Leaf, and Myers, are now claimed by the older boys and girls

For the younger children, "The Adventures of Odysseus" by F S Marvin, and Padraic Colum's "Adventures of Odysseus" and the "Tale of Troy" are excellent renderings in attractive modern form Mr Colum has also retold classics from the Celtic and Norse

Ever since Hawthorne naturalized the Greek myths for American children in "The Wonder Book" (1851), publishers have looked to the field of the retold and abridged classic as the

basic source of supply for children's books worthy of reissue in beautiful form There have been many distinguished contributors to this field—Charles Kingsley, William Morris, Sir Arthur Quiller-Couch, Andrew Lang, James Stephens, Walter de la Mare, and Howard Pyle

The novel has had its place in literature for children ever since "Robinson Crusoe" appeared in 1719, and children have had their place in the novel ever since Charles Dickens and Hawthorne, each in his own way, placed them there Many a novelist, from Defoe to Stevenson, owes his continued popularity to boy and girl readers, or his place in literature to his power of portraying child character

A renaissance is taking place in several countries pointing toward the development of a literature for children more distinctively international in character It is a noteworthy fact that the most forward step in this direction has been taken by Czechoslovakia, where children's books and their illustrations have been made by governmental provision a subject of critical study (*See* list of books for children to read in Fact-Index under Literature for Children)

Lithography. A method of drawing on, and printing from, smooth stone slabs or zinc or aluminium plates lightly etched in relief The process as invented by the German, Alois Senefelder, in 1796, is as follows The design is drawn on the specially prepared surface of a large, thick slab of close-texture stone, either in a greasy lithographic ink or by lithographic crayon, which is composed of soap, lamp-black, wax, and oil The stone is then lightly etched with a solution of acid and gum arabic, the purpose being to set the ink of the design and to render the blank parts of the stone more retentive of water

In printing the surface is wetted, but the water remains only upon the blank portions of the stone When the printing rollers, carrying a special greasy lithographic ink, are run over the stone, the wetted portions repel the ink, which is taken only by the parts covered by the design A sheet of damp paper is then pressed upon the slab in much the same manner as that adopted in the case of ordinary printing If several colours are to be used, a different stone must be prepared for each colour

The difficulty of obtaining large-size flawless slabs of the stone used (an especially porous form of limestone, called lithographic stone and found only at Solenhofen, Bavaria) led to the use of zinc sheets and, later, aluminium as substitutes These sheets have an added merit over the heavy stones in that they can be shaped to a curved cylinder, producing more rapid printing, but they have certain disadvantages, and real stone is still used for the finest work Many artists also prefer not to draw direct on the stone, but to transfer a drawing made on paper, also specially prepared for the purpose The drawing is made in red pencil or charcoal and gone over with lithographic crayon It is then damped and pressed on to the stone The drawing is then transferred, and all marks not covered by the lithographic crayon are later etched off with the acid solution

In commercial printing, lithography is chiefly used when several distinct colours are to be printed, as, for example, in maps and in large coloured posters But when one colour has to be printed over another to get fine gradations of colour the three-colour process is used

Lithuania. Founded as part of the territories of the Crusading Knights of the Teutonic Order, Lithuania was at one period the largest of the states of Europe, for at the beginning of the 15th century its boundaries extended from the Black Sea to the Baltic But it was then united with Poland, and became a dependency of Russia when the famous "partition" of the former country was made, and in the 19th century an imperial edict abolished the very name of Lithuania Through all the vicissitudes of their history, however, the Lithuanians have kept their identity as a people, and now, since the World War, they have once more become a nation

Lithuania was the largest and the most southerly of Russia's three Baltic states, and,

Doreen Leigh

LITHUANIAN WOMEN

The women of Lithuania are extremely skilful needlewomen Their gowns are often elaborately embroidered in bright colours though white would be worn on all important church festivals

like Latvia (Livonia) and Estonia, it was and is chiefly an agricultural country. Forests and marshes cover much of the land, and less than half of it is fit for the plough. Rye, oats, barley, wheat, potatoes, and flax are the leading crops. Stock-raising, poultry farming—particularly the rearing of geese—and bee-keeping are important occupations. Grain, cattle, hams, poultry, eggs, butter, timber, flax, linseed, hides, and wool are exported. Memel (Klaipeda) on the Baltic Sea—taken from Germany by the Peace Conference in 1919 and occupied by the Lithuanians in 1923—was the chief port until handed back to Germany in 1939 following an ultimatum.

Besides the people of Lithuanian stock, there are many Russians, Jews, and Poles, as well as some Letts, Germans, and other peoples. The Lithuanians, who had striven for self-government since 1905, declared their independence of Russia in February 1918. In October 1939, Russia made insistent demands for military rights, and these the Lithuanians were unable to resist. However, in return they received the ancient capital Vilna, or Vilnius (population 207,750), which had been in the possession of Poland, as had Gardinas or Grodno (population, 61,600), since 1920. The government of the republic is carried on from Kaunas, or Kovno (population, 105,000). The total population of Lithuania is about 2,500,000. About 70 per cent of the people are Lithuanians.

Extent.—Of independent Lithuania (excluding Memel, which was handed to Germany in 1939 following an ultimatum), 20,390 square miles. Population, 2,374,000.
Physical Features.—A level forested area. Chief river, the Niemen.
Principal Products.—Cereals, flax, potatoes, dairy produce, timber.
Chief Cities.—Kaunas or Kovno (seat of government), 105,000, Vilnius (Vilna), 207,750, and Gardinas, 61,600.

Liver. This is one of the most important digestive organs in the body and is found in all animals that have a backbone, as well as in some that have not. The liver in Man is situated in the abdominal cavity, on the right side, slightly above and behind the stomach. It is the largest gland organ of the body, weighing from three to four pounds.

The liver has four main functions. (1) It produces bile, which aids in the digestion and absorption of fats, and is the vehicle that carries some waste material from the body. (2) Glycogen (or animal starch) is formed from the sugar circulating in the blood after digestion, and is stored away in the liver cells, to be given out again to the blood as sugar when it is needed by the muscles of the body. (3) The liver, during the digestive process, forms *urea*—one of the wastes of the human body resulting from protein metabolism—which must be excreted. (*See* Kidneys.) (4) The liver also has an important duty in preparing fats for oxidation in the body.

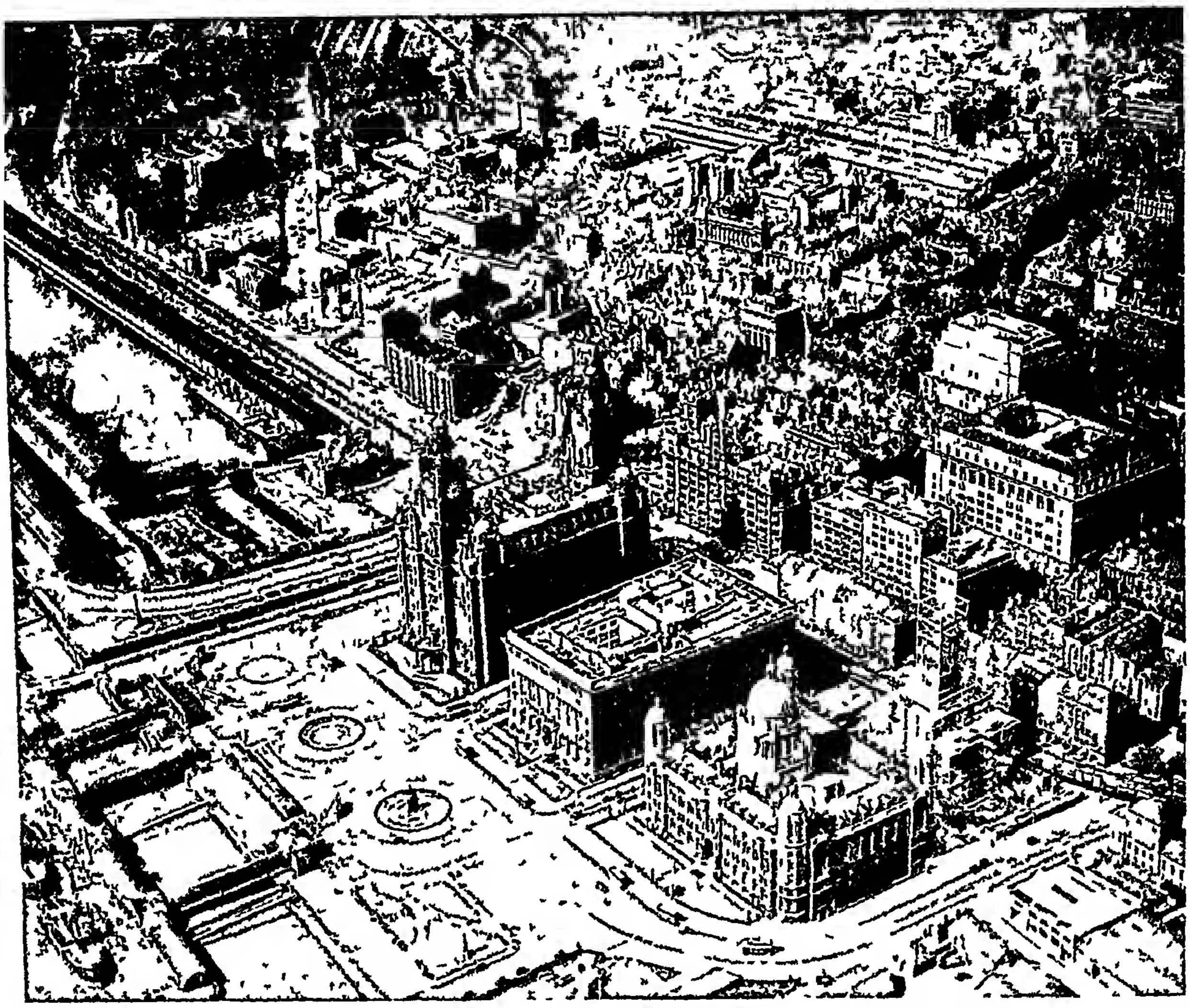
The liver differs from all other organs of the body in that nearly all the blood passing through it is venous blood.

Blood flows into it from two sources; the small hepatic artery brings arterial blood to feed the liver cells, and the large portal vein brings all the venous blood from the stomach and intestines to the liver before it goes back to the heart. This forms what is called the *portal* circulation and may best be likened to a short circuit in the general systemic circulation. The liver makes important changes in this blood before it passes on to the general circulation, taking from it several nutritive elements and giving to it waste products which will later be excreted by the kidneys.

Liverpool. If you pay a visit to this great port by steamer you may not be impressed by the seven-mile stretch of grey granite-walled docks, but look well at these docks, for they are a marvel of industry.

In one dock and another vessels are unloading wheat from Australia, cotton and coffee from Brazil, grapes and wine from Spain, rice from Calcutta, india-rubber from Singapore, and maize from South Africa. Fleets of passenger ships arrive and leave by every tide, and the warehouses store goods from all over the world.

The Mersey estuary, on the Lancashire shore of which Liverpool is situated, suffers from shifting sand-bars across the channel, and from a tide with a vertical rise and fall of 30 feet. To remove the sand the Mersey Docks and Harbour Board keeps a powerful fleet of dredgers constantly at work. The advantages of a tideless harbour have been practically secured by a wonderful system of "wet docks," operated like the locks on a canal. When a ship enters one of these basins, a water-gate closes behind it and remains closed, holding the water at a constant level, until the ship is ready to sail. The docks have a water area of about 570 acres with 37 miles of quayage. One dock, the Gladstone, can take some of the largest vessels. The great floating landing-stage is really a half-mile raft supported on floating pontoons. Officially, the northern half is devoted to ocean steamers, while the southern part is for ferry traffic; but its 80-foot width permits it to be used as a street, a promenade, and a pleasure park. The Docks and Harbour Board, occupying one of the largest buildings on the waterfront, also controls the dock system on the Birkenhead side of the Mersey, to which runs the world's largest under-water tunnel (nearly three miles in length), known as Queensway. The Anglican cathedral, designed by Sir G. C. Scott, was begun in 1903. Sir Edwin



ON LIVERPOOL'S WATERFRONT

This photograph taken from the air shows the space overlooking St George's landing-stage, known as the Pierhead On it stand three of Liverpool's most famous buildings On the left is the Royal Liver building which houses the Royal Liver Friendly Society and other offices, in the centre is the Cunard-White Star building, while on the right are the Dock Board offices The dock in the extreme left of the photograph is the Princes Dock

Lutyens designed the new Roman Catholic cathedral, now also in course of erection Its dome will be one of the largest in the world

Liverpool has many manufactures, but it does not owe its importance to them Its fortune has always lain on the water, even in the ancient days when a safe beaching ground for fishing boats, out of the swift currents of the Mersey, was afforded by a shallow little tributary, the Pool A few fishermen, whose huts huddled near the present site of the Liverpool Town Hall, paid tribute to the lords of the manor of West Derby The Pool has long since been filled up, West Derby has shrunk to a suburb, but the gigantic seaport of Liverpool, with its 855,500 population (many of them Irish or Welsh), lives today by grace of the Mersey, as did the fishing hamlet eight or nine centuries ago

Liverpool's commercial importance began late—with the Stuart Restoration in the 17th century—and it had to outstrip first Chester and then Bristol before its position became commanding In the latter half of the 18th century the power loom began to make Lancashire the world's greatest cotton-manufacturing centre, and Liverpool its chief port Raw cotton is still the chief import, and the cotton goods of Manchester and other Lancashire towns the chief export, though some trade is now diverted through the Manchester Ship Canal

Liverworts. The next time you notice a flat creeping, rather fleshy-looking plant, with rounded lobes to its leaflike body, and no separate stem, leaves, or flowers, examine it carefully It is probably a liverwort—a simple flowerless plant, one of the first types of land plants in the earth's history The liverworts got their name from the fact that they were once believed to be beneficial in diseases of the liver, or perhaps from their shape, which in some varieties looks like that of the human liver

They are usually of a bright green hue, and they grow most luxuriantly on wet rocks, logs, or on the ground in ravines and other moist,

shady places Many are so small they are easily overlooked Others are much like mosses and are often confused with them Others, again, are large and conspicuous, with their upper surface green, and the lower surface covered with numerous fine white hairlike rootlets called "rhizoids" Some of these liverworts have little green cuplike organs, called "cupules" (Latin *cupula*, little tub), containing tiny greenish balls, known as "brood buds" or "gemmae," which grow into new plants

The liverworts have also another mode of reproducing, by growing tall umbrella-like organs, some of which (called archegonia) bear little eggs, while others (antheridia) bear very tiny, actively swimming cells, called "sperms" During wet weather the sperms swim to the archegonia and there fertilize the eggs, which grow into tiny plants, rooted in the archegonium, and containing many very small brownish spores These spores fall upon the ground and there grow into liverwort plants, and so the cycle goes on

The liverworts are in many ways related to the mosses, and with them compose a great division of the vegetable kingdom, the *Bryophyta*, the liverworts forming the group *Hepaticae*

Livery Companies. The City Guilds or Livery Companies of the City of London are descended from the old mediaeval trade guilds It was compulsory for every trader to join his particular company, and to wear its livery, but

R M Adam

LIVERWORT 'IN FLOWER'

Normally, the liverworts are flattened, greenish or greyish bodies, fond of moist places and gloomy, damp old walls But this one is producing an enormous number of "archegonia," the female organs of reproduction, more or less equivalent to flowers in this strange member of the plant community

nowadays membership is not reserved for followers of any particular profession

There are now 78 guilds in existence, the twelve "great" London companies being the Mercers, Grocers, Drapers, Fishmongers, Goldsmiths, Skinners, Merchant Taylors, Haberdashers, Salters, Ironmongers, Vintners, and Clothworkers Each company is governed by a court, which includes the Master and Wardens

The MISSIONARY-EXPLORER *of* AFRICA

This is the wonderful life-story of David Livingstone, who braved the many dangers of the African wilds during thirty years of exploration and missionary work—a man of the highest ideals and greatest courage.

Livingstone, David (1813–1873) How does it feel to be crunched in the jaws of a lion? Dr Livingstone, the famous British missionary and African explorer, was one of the few men who knew and lived to tell the tale

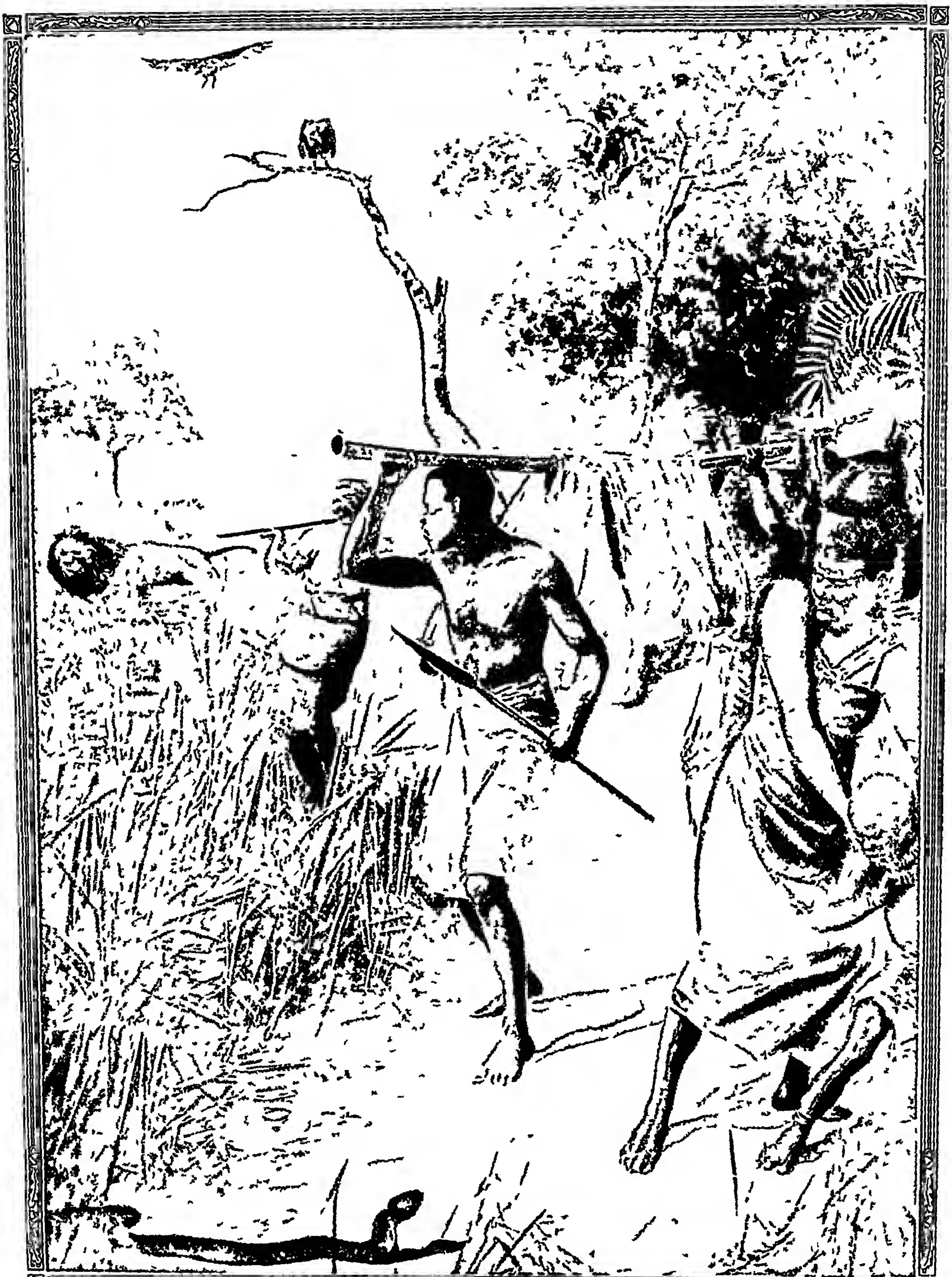
Soon after he began his work in South Africa he was sent to establish an advanced station in the heart of the wilderness some 800 miles north-east of Cape Town The "charming valley," proved to be infested with lions

At a distance of 30 yards Livingstone fired two bullets into one of these ferocious beasts, severely wounding it Then with a roar it hurled itself upon him, crushing his left shoulder in its jaws, and bearing him to the ground "Growling horribly close to my ear," wrote Livingstone, "he shook me as a terrier does a rat The shock produced a stupor similar to that which seems to be felt by a mouse after the first shake of a cat It caused a sort of dreaminess, in which there was no sense of pain nor feeling of terror, though I was quite conscious of all that was happening" Fortunately the lion soon left Livingstone, and fell dead of its wound

But no dangers of this sort, neither hunger, fever, attacks by hostile Boers or native cannibals, the perfidy of Arab slave traders, nor any of the countless perils that beset him could damp his ardour, or make him abandon his chosen field His patient resourcefulness, courage, fair dealing and Christian character laid the basis for missionary work over a large part of South and Central Africa In addition, no other explorer ever did so much for African geography as Livingstone

Livingstone was born in 1813 at Blantyre, in Scotland As his parents were poor he went to

LIVINGSTONE'S LAST SAD JOURNEY TO THE SEA



It was a scene worthy of the epic grandeur of Livingstone's life of sacrifice and service in the African wilderness that his body should be carried to the sea in this way by his devoted black servants through 1,000 miles of savage waste. This picture shows the perils through which his followers passed on that sad journey. See that brave fellow in the front, with his spear ready in case the man with the rifle should miss his mark.

work in a cotton mill at the age of ten With his first earnings he bought a Latin primer Although work at the factory began at six in the morning and lasted ten hours or more, he attended night school and studied at home until he had read Virgil and Horace

In his 20th year he was thrilled by reading an account of a missionary's labours in Asia, and, as he says, "resolved to devote my life to the alleviation of human misery" Then followed college classes in Glasgow, examination and acceptance by the London Missionary Society, the completion of his medical education in London, and studies of theology, botany, zoology, geology, chemistry, and astronomy —all with a view to his future life-work At last came his arrival at Cape Town in 1841

For over 30 years Dr Livingstone travelled up and down Africa, from the Cape nearly to the Equator, and from the Atlantic to the Indian Ocean He discovered the famous Victoria Falls on the Zambezi, Lake Nyasa, Lake Bangweolo (where he was to die), and the upper course of the mighty Congo, there called the Lualaba and thought by Livingstone to be the upper Nile He also explored much of Lake Tanganyika, which Burton (*q v*) had discovered in 1858

His small salary and the money that he made from his books went to equip new expeditions During the last fifteen years of his life he was helped by the British Government, from which he held a roving appointment as Consul

Two great objects cherished by Livingstone were the stopping of the Arab slave trade in Africa, which he called the "great open sore of the world," and the discovery of the sources of the Nile The descriptions of the horror of the slave raids which he sent to England helped in time to stamp out this ghastly trade He was never to find the sources of the Nile, however

About six months before he died a relief expedition sent by the "New York Herald" under H M Stanley (*q v*) found him at Ujiji on Lake Tanganyika, in the midst of great privations and weakened by fever, following the desertion of some carriers with supplies and his precious medicine chest Stanley tried to persuade him to return to civilization, but he refused

After the relief party had left, Livingstone again started west, looking for the sources of the Nile His old enemy dysentery, attacked him, with complications brought on by excessive hardships, and he grew steadily worse On the morning of May 1, 1873, his men found him kneeling beside his cot, dead His faithful native attendants, who loved him, preserved the body as best they could and carried it half way across Africa to Zanzibar From there it was taken to England and buried with all honours in Westminster Abbey A monument has been erected where he died, and there is a statue of the discoverer at the Victoria Falls

WINNING FRIENDSHIP WITH A WATCH
On one occasion when Livingstone was doubtful of the friendliness of the natives, he produced a remarkable impression among them by exhibiting his watch This "magic worker" instantly won respect for its owner

Courtesy of London Missionary Society

Livy, (TITUS LIVIUS) (59 B C–A D 17) Among the literature called classical, the works of Titus Livius, commonly called Livy, the Roman historian will always hold an honoured place Livy was born at Patavium (Padua), in Northern Italy, and after settling in Rome he became one of its leading citizens The great work of Livy's life was the writing of a history of Rome from the date of the foundation of the city, 753 B C, to 8 B C

Originally this great work consisted of 142 books, but of these only 35 have survived in their entirety, although the existence of a sort of abridged edition of the whole history has enabled the blanks in the original work to be filled in to a certain extent His object, as he says in his preface, was to recall to his contemporaries Rome's mighty past, and to hold up former great characters as examples to them He excelled in his vivid descriptions of battles and sieges

It is wonderful how his works survived at all, considering the calamities in which Rome

THE FRILLED LIZARD—A MYSTERIOUS REPTILE

Found in Queensland and New South Wales the frilled lizard is one of the most mysterious of creatures for no one knows the purpose of the strange frill round its neck. This is raised when the reptile is annoyed—perhaps it is a bit of bluff to make it seem a terrible monster. There is no apparent reason either, for its habit when running of rising on its hind legs and proceeding more like a human being than a reptile on two legs alone. In all the frilled lizard is about three feet long.

Photo Lady Broughton

'DRAGONS' OF TODAY A PAIR OF THE GIANT MONITOR LIZARDS OF KOMODO

The largest living lizards are the "Komodo dragons," inhabitants of one of the remote islands of the East Indies, after which they are named. Until this photograph was taken there was little reliable information concerning their habits and real appearance, for so large are they—their length is over 12 feet—that exaggerated reports made them seem unbelievable. They have a power and dignity not seen in any other lizards, except perhaps the great marine iguanas, but unlike those creatures the "dragons" are carnivorous

was involved in its fall, and, as a matter of fact, some of Livy's writings were not discovered by scholars until medieval times

Livy was held in high repute by the scholars and writers of Rome who came after him, and his works are often referred to in terms of lofty appreciation by Tacitus, Seneca, and others There are several English translations of Livy, but, though they give us the substance of his work, they give us no adequate idea of his great literary style Among scientific historians Livy has no place, as he was quite uncritical in his methods, being content to accept his facts from previous writers, without any attempt at independent investigation Yet for all his faults Livy remains among the immortals

Real 'DRAGONS' *of* MODERN TIMES

Very like miniature dragons are the little lizards so common in the countryside, and, though they do not breathe fire, they have some habits almost as strange—as we learn from this article and its pictures

Lizards. If you saw in a cage a specimen of each of the 1,700 different kinds of lizards that have been found in the world, you would hardly believe that animals of such widely different shapes, sizes, colours, and habits could possibly belong to the same big group of reptiles

Frilled lizard of Australia

You would see tiny creatures two or three inches long lying beside giants measuring from ten to twelve feet Bright greens, blues, and reds would stand out among dull greys, browns and blacks Most of them would show four sturdy legs, with long toes and even claws, but there would be some with only front legs, some with only back legs, and some with no legs at all Tree-lizards, ground-lizards, and water-lizards would be mingled together, some darting about, others sluggish and still

Here and there you would find a sleek, slender, lively, and even graceful creature, but many of them would probably impress you as misshapen, repulsive monsters Yet, if you judged by looks alone, you would do the lizard tribe an injustice, for only two of the 1,700 species are poisonous—the heloderm of western Mexico and the Gila monster of the south-western United States

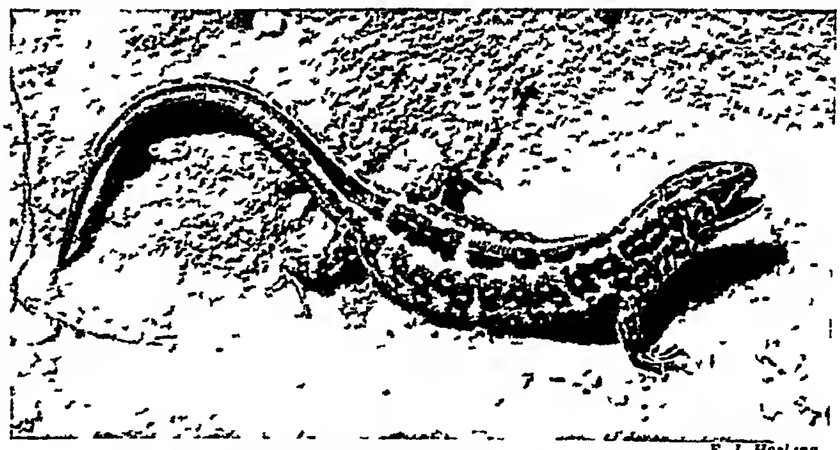
Present-day lizards are blood brothers of the snakes, and both orders together form the sub-class *Sauria* of the reptilian class of animals The relationship can be traced through many details of internal anatomy and is very close, in spite of the great difference in external appearance

While lizards are found in nearly all except the colder parts of the earth, they reach their greatest numbers in tropical lands Most of them catch living prey, the smaller ones feeding usually on worms and insects, the larger ones devouring mice, frogs, other lizards, snakes, young turtles and crocodiles, fish, birds—in fact, almost any animals they can overpower

There are some important varieties, however, that prefer a vegetable diet, notably most of the larger members of the iguana family of tropical America some of which reach a length of six feet

How the Lizard Loses Its Tail

Perhaps the most amazing peculiarity found in the lizard tribe is the faculty which many of its members possess of casting off their tails When seized by a foe from behind, the tail breaks off between two of the joints of the backbone The severed part continues to wriggle for some time, catching the attention and satisfying the hunger of the pursuing foe, while the more important part of the lizard escapes



F J Hosking

BEAUTIFUL SAND LIZARD OF THE HEATHS

The most beautiful of our English lizards is certainly the one you see above, the sand lizard It is not very common, but is found on sandy heaths in the south of England This one is rather angry, and is snapping at something the photographer has held out at him to attract his attention

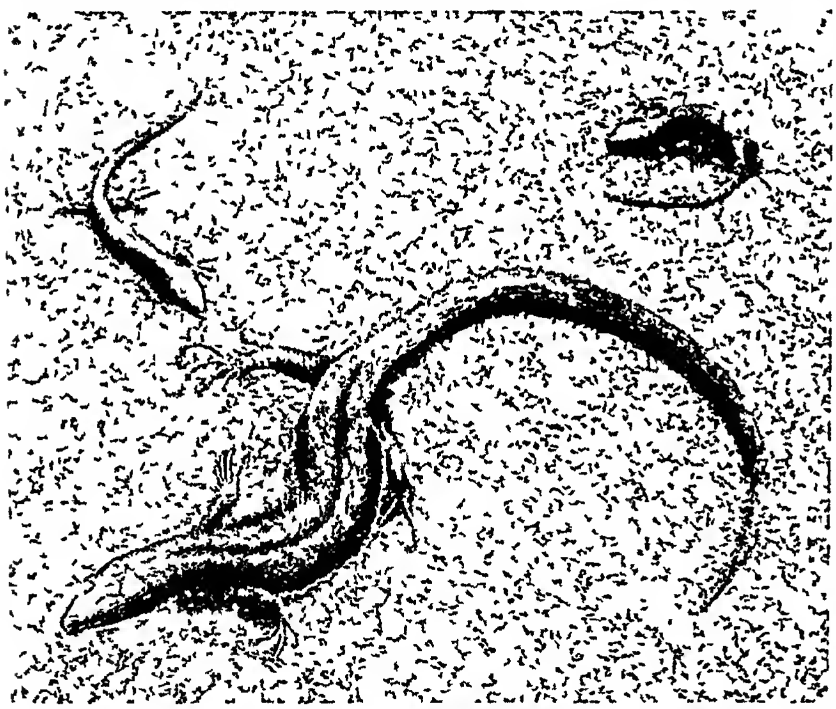
Some species will abandon their tails even before they are seized Such mutilation seems to cause them no inconvenience, for they at once set about growing a new tail Not infrequently they produce by way of consolation two or three new tails in place of the one they have lost

Another strange practice among certain large lizards, notably the frilled lizards of Australia and the teguexin of the West Indies and South America, is that of running swiftly and for great distances on their hind legs When doing this, their front legs swing to and fro like the arms of a human runner and their tails project stiffly backwards and upwards to balance them, making them look like strange birds Indeed, the whole performance recalls sharply the fact that millions of years ago birds emerged from reptilian ancestors

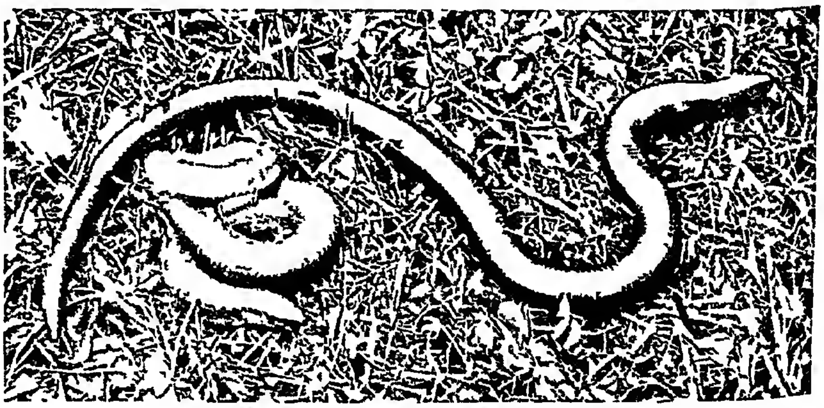
The frilled lizard mentioned above gets its name from the broad collar of loose skin it wears round its neck, which it spreads out like an umbrella when frightened or angered, at the same time opening its mouth wide and hissing venomously—all of which is pure bluff Such "scarecrow" tricks are common among lizards The hooded basilisk, which is named after the fabled monster that was supposed to turn a beholder to stone with its glance or breath, is a conspicuous example of such "frightfulness" Being about three feet long, and possessing jagged crests which it can raise at will on its head, back, and tail, this creature is regarded as an object of terror by the native children of Central America

Not all lizards are equally placid Though non-poisonous and inclined to mind their own business, some of them are fierce fighters and biters when annoyed This is particularly true of the monitor family, whose members are scattered through Africa, Arabia, southern Asia and Australia One water-loving species (*Varanus salvator*) sometimes attains a length of more than eight feet, while the largest of the whole lizard tribe is the famous Komodo dragon, *V komodoensis*, which is very possibly the original of many oriental dragon legends

In contrast with this vigorous and short-tempered creature are those most helpless of all lizards, the glass-snakes, sometimes called blind-worms or slow-worms, and the strange amphisbaenas Both are



The nearest thing to flying found among the lizards, however, are the long sailing leaps from tree to tree performed by the small flying dragons of the Malayan countries The "wings" of these creatures are formed by the outward extension of the ribs, which are connected by thin membranes of skin When at rest, they lie close to the creature's sides, but when a leap is made, they spread out like fans, supporting the lizard like a parachute as it glides through the air, often for remarkable distances



LIZARDS, WITH AND WITHOUT LEGS

Both the photos above show lizards, but though you would easily recognize those in the upper one, the lower creatures may provide a puzzle They are slow-worms, one of our English lizards that has no legs, and the others are common lizards, a female with her newly-born young Both are common species

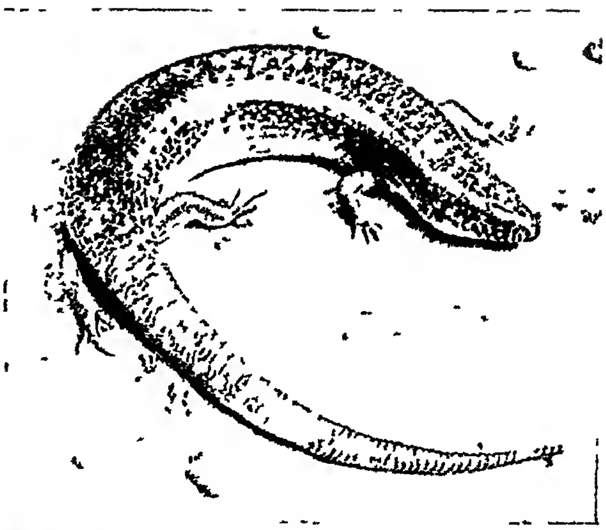
Photos top A R Thompson bottom John Kearton

devoid of legs, although some possess useless external flaps in place of feet The former is, of course, neither a snake nor a worm, nor is it blind Its small bright eyes are equipped with eyelids, a thing unknown among true snakes The "glass" part of its name arises from the fact that it becomes rigid when captured and breaks off at the tail if not handled very gently This creature is common in many parts of England

The amphisbaena has eyes and ears both concealed by growths of skin This lizard lives in the ground, and it can move backwards or forwards with equal ease like an earthworm

Although most of the lizards have no voice beyond an angry hissing, the night-loving gecko family is distinguished for its ability to emit a variety of cries, all resembling more or less the sound from which they derive their name The geckos are small creatures, very useful for the number of insects they destroy Some are sand-runners, others tree dwellers, and a few varieties penetrate dwellings in search of food These have feet equipped with tiny pads and hairs, which enable them to climb up a pane of glass or walk on a smooth ceiling

While the geckos have been in many lands unjustly persecuted from the popular belief that they spread mysterious poisons, another group of small lizards, the skinks, have been regarded from the earliest times as possessed of equally mysterious medicinal properties The head and feet of the common sand-burrowing skink were preserved in wine and imported in great quantities to ancient Rome The Arabs of today still use them as medicine and food



TWO STRANGE AND UNPLEASANT LIZARDS

The upper picture shows a skink, a creature various parts of which have long been used in oriental medicine In the lower photograph is a much more dangerous beast, the dreaded Gila monster, one of the few poisonous members of the lizard tribe Its coloration, black with pink or yellowish markings, at least serves to render it conspicuous, so if anyone gets bitten by a Gila monster, it is probably his own fault!

Photos top W S Berridge bottom G P A

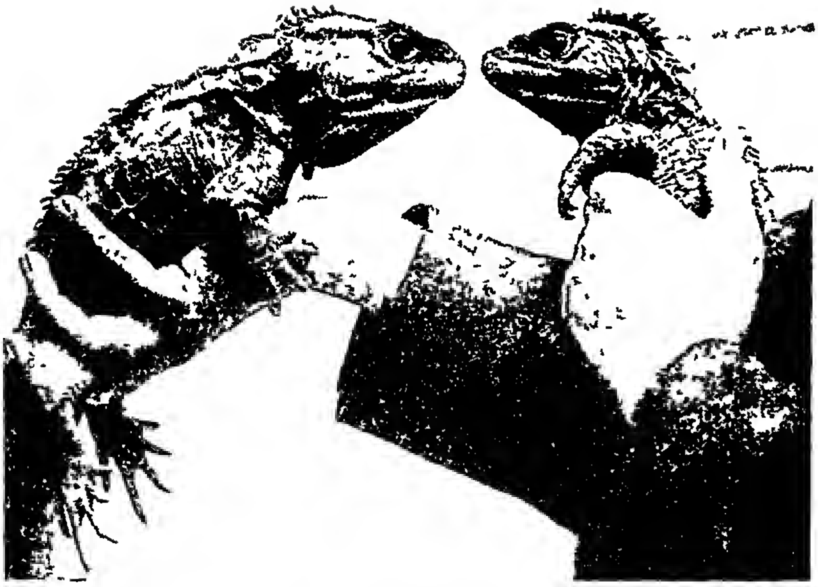
Nor is this the only example of lizards being eaten by Man, for the iguanas of America and many Australian, Asiatic, and African species are highly relished by the natives

Among the best-known of North American lizards are the poisonous Gila monster and the gentle, friendly horned toad The former, which sometimes reaches a length of two feet, was first found in the Gila River valley in Arizona Its sluggish body is marked with big orange or pinkish blotches and rings on a black background The poison-sacs lie near the root of its grooved teeth, and its bite quickly kills the small animals on which it preys In rare cases it has been fatal to Man Its near relative, the heloderm, has yellow instead of orange spots

The horned toad, so called because of its flat, squat, toad-like body is found throughout the dry plains and deserts of the western and south-western United States and in Mexico It is covered with short sharp spines, particularly about the head, which protect it against being swallowed by snakes Similar but not closely related forms occur in Australia

Besides the slow-worm already mentioned, we have in Britain two other native lizards, the common lizard (*Lacerta vivipara*) and the sand lizard (*L agilis*), while several others, such as the true green lizard (*L viridis*) and the wall lizard (*L muralis*) have been introduced All of these are typical little lizards, quick-moving, amusing, and difficult to catch

Two close relatives of the lizard tribe, the chameleon and the tuatara of New



LIZARD SURVIVOR FROM PREHISTORIC DAYS

The tuatara, a lizard native to New Zealand, is one of the world's most remarkable creatures, for it is a survival of lizard types that died out everywhere else millions of years ago, and is thus virtually a living prehistoric creature These two specimens are in the London Zoo

Zealand, are of immense interest to scientists The story of the chameleon is told elsewhere (*see* Chameleon), but the tuatara (*Sphenodon*) deserves mention here because this singular creature is the sole surviving member of a group of reptiles otherwise extinct millions of years ago The bodily structure of this "living fossil" has given science a key to the evolution of the whole reptile group, for it retains traces of many of the primitive bodily forms, notably a well-developed "third eye" buried beneath the skin of its forehead, which is a remnant of the third eye actually possessed and used by certain prehistoric reptile ancestors

Lizards are "cold-blooded," like all reptiles Some lay from one to twenty eggs, but others produce living young, and the specific name of our own *Lacerta vivipara* refers to this Their skin, like that of snakes, is normally covered with scales, and from time to time they shed the thin, horny outside coating

The family history of the lizards is particularly interesting because of its many relationships with the birds and mammals You might think at first that the lizards are very small descendants of the prehistoric monsters that once roamed the earth Actually, the original reptiles were evolved from amphibians (*see* Reptiles), and from them developed the monsters, which, however, proved unable to survive On the other hand, the primitive reptile stock was still in existence and Nature's second effort produced small, fleet animals, capable of surviving under the new conditions These "second effort" animals were the lizards and reptiles as we know now them

At about the time when the lizards were appearing, Nature was also producing (from much the same type of primitive reptiles, according to one theory) the first birds, and possibly even the forerunners of the early mammals

Llama. Among the most curious of all the larger animals is the hissing, spitting llama of South America Although related to the camel of the Old World, the llama has no hump Its wool is not so valued as is that of the semi-domesticated alpaca and the vicuña, its near relatives, which, like the llama, live in the Andes of Bolivia, Peru, and Chile, for llama wool is coarse and rough and is suitable only for twine and very coarse cloths The male llama is chiefly valued as a beast of burden, and the females are useful for their milk and meat, which resembles mutton The llama is a domesticated form of the wild guanaco, which is still found in the Andes

Sport & General

MRS AND MISS LLAMA

Most very young animals have a peculiar charm, and this little llama with her mother—inhabitants of the Whipsnade Zoo—is no exception But these creatures have unpleasant habits, notably that of spitting violently at anyone rash enough to annoy them when within range

When the Spaniards conquered Peru in the 16th century, they found the Incas of that land using hundreds of thousands of llamas as riding animals and beasts of burden In the whole New World these were the only domesticated animals except dogs, and the lack of such helpers to Man as the horse, ass, ox, sheep, and pig was one of the reasons why the New World lagged behind the Old in civilization The Spanish conquerors continued to use the llamas, and long strings of these animals in charge of a few native drivers were soon carrying silver by the narrow mountain trails from the mines to the coast Until the middle of the 19th century llamas remained almost the only means of transportation employed in the Andes Even today, in the more inaccessible parts, this beast is still essential for transport purposes

The llama (*Lama huanacus glama*) is about three feet high at the shoulders and is capable of carrying 120 lb at the leisurely rate of 12 miles a day If treated well, llamas are willing and docile They gather their own food, are hardy, and can travel over places too rough and steep for any other burden-bearing animal If overloaded, they will lie down and refuse to move When disturbed, they spit a ball of food and saliva at their tormentor

BRITAIN'S '*Win-the-War*' PREMIER

For fifty years a dominant figure on the political stage, Mr Lloyd George will live in history as a great social reformer and, still more, as the man who led Britain to victory in the greatest war in history

Lloyd George, David (born 1863) At the age of seventeen this Welshman, who for eight epoch-making years was Prime Minister of Britain visited the House of Commons for the first time He wrote in his diary, "I will not say that I eyed the House of Commons in the spirit in which William the Conqueror eyed England on his visit to Edward the Confessor," but already he was dreaming of future political greatness

His own hard youth had made him a Radical in politics Born in Manchester, he was left in poverty at the age of three by the death of his schoolmaster father, William George, and was reared and educated by his mother's brother—Richard Lloyd, a village cobbler of North Wales—whence his second name of "Lloyd" He studied law and at the age of twenty-one was admitted to practice as a solicitor Almost at once he made his mark by his earnestness in defending the rights of Welsh Nonconformists And soon he was elected to Parliament as a Liberal from the Welsh constituency of Caernarvon, a seat which he held for over 40 years

Howard Coster

DAVID LLOYD GEORGE

The name of David Lloyd George will always stand supreme among those statesmen who served their country during the World War His forceful personality and unconquerable will to win inspired not only the Government but the whole Empire during the darkest days of 1914-18

In Parliament he showed himself fearless, quick and biting in reply, and he speedily won attention When the Liberals came into power at the end of 1905, Sir Henry Campbell-Bannerman, the new Prime Minister, offered Lloyd George a place in the Cabinet as President of the Board of Trade

When, in 1908, Asquith succeeded Campbell-Bannerman as Prime Minister, he asked Lloyd George to take the second place in the Cabinet, that of Chancellor of the Exchequer The friend of the poor now had his chance It was his first duty to bring in the Budget To provide funds for the Old Age Pension Act, Lloyd George proposed many new taxes which took the burden of taxation from the shoulders of the poor and put it on those of the rich

"I made up my mind that in framing the Budget which was in front of me," he said, "no cupboard should be barer, no lot harder to bear " This Budget was much more than a financial proposal for the year, it was a programme of social change In support of his Budget Lloyd George delivered a speech at Limehouse which was so vigorous in denunciation of the rich that it gave rise to the term "Limehousing," descriptive of this style of oratory The House of Lords rejected the Budget, and then the Prime Minister gave notice that the government proposed to limit the power of the Lords A great struggle followed and two elections were held within a year The Lords were at length defeated, and the

Parliament Act of 1911 destroyed the power of the Lords to reject a money bill

Immediately Lloyd George produced a new programme of social legislation The chief measure passed provided working men with state-guaranteed insurance against sickness and unemployment, with free medical service, payment of partial wages during periods of disablement, hospitals for tuberculosis, and maternity benefits for their wives, etc This legislation entitles Lloyd George to rank as one of the greatest practical social reformers in history, and caused him to be regarded for many years as the champion of the working classes of England

When the World War broke out in 1914, many people expected that he would resign But after Belgium was invaded he came out in unmeasured terms against Germany's aggression

As Chancellor of the Exchequer it was his first task to provide the money—"silver bullets"—without which Britain could not hope to win He gained the confidence of the banking and landed interests, hitherto his bitterest enemies He was one of the first to realize that Britain was being outstripped by Germany in the quantity and quality of the shells manufactured, and so was given the new post of Minister of Munitions By his enthusiasm and dynamic energy he organized the manufacture of munitions in every corner of the kingdom, and soon the British Army was as well equipped as the German with armaments

But Lloyd George became more and more restive under Asquith's government, feeling that the war was not being prosecuted with that single-mindedness of purpose and determination which alone could avert defeat In December 1916, he overturned his chief and himself became Prime Minister, with the consent, and at the wish, of the leading politicians and soldiers In his new capacity he gathered round him trained men and gave energy to the war He stood out relentlessly against the talk of a "peace by compromise," rallied the faint-hearted, pressed the supplies of munitions, and re-organized the Army staff in spite of opposition There was reason and method in all his actions

The outcome of the war abundantly justified his policy, and in the "khaki election" of November, 1918, he was returned to a House of Commons containing a large majority of his supporters

At the Peace Conference Lloyd George steered no consistent course At one time he seemed to be with France in her efforts to destroy Germany once and for all, at another to be with President Wilson in his efforts for a peace based upon reconciliation and the rights of nationalities Here, however, as earlier in his career, he showed his genius for conciliating and bringing to some kind of agreement persons of widely opposing views

LLOYD GEORGE AT THE FRONT

Both as Minister of Munitions and as Prime Minister, Mr Lloyd George (right) went many times to the front during the World War He is here seen in conference with Sir Douglas Haig, General Joffre, French commander-in-chief until 1917, and M Albert Thomas, the French Minister of Munitions

Imperial War Museum

In the troubled times which followed the Peace, Lloyd George faced problems connected with Ireland, labour, and reconstruction which were almost as appalling as those of the war His majority in Parliament remained unshaken, largely because there was no other leader in sight who could hope to do any better in reconciling conflicting claims, and so he continued in power as a man without a party

Towards the close of 1922 criticism of Lloyd George's Near-East policy foreshadowed the government's fall Then, at a meeting of the Conservative Party it was decided to contest the forthcoming election independently, and on the resignation of certain of his ministers Lloyd George relinquished the Premiership In 1929 he sponsored a programme of national reconstruction, but was unable to secure the country's approval

His "War Memoirs," in six volumes, appeared during the years 1933-1936 While remaining active in politics as the "Father of the House," Lloyd George devoted in his later years much time to his farm at Churt, in Surrey

Lloyd's. There is no higher praise than "A 1 at Lloyd's" (*see* A 1), whether or not the current expression derived from this oldest and greatest of marine insurance societies refers to health, condition, or financial stability So

common, and yet so uniquely expressive, has this phrase become that government bodies and national propaganda refer to an A 1 nation as meaning the last word in fitness

From China to Peru, Canada to Australasia, Lloyd's certificate of efficiency, backed by Lloyd's financial strength and traditional foresight, is a recognized world hall-mark, and has been so for nigh on three hundred years But, as with most great growths, its beginnings were small

Lloyd's had its origin in the coffee-house in Tower Street, London, of one Edward Lloyd about 1690 Very little is known about Lloyd, other than that he had three wives and many children and had been a constable His establishment was a resort for business men interested in shipping and foreign trade, some of whom were willing to act as insurers Shipowners and others looking for insurance underwriters soon found it easier to go to Lloyd's than to make the rounds of offices Thus the first great insurance committee originated in the same way as did the clearing-house, out of a mixture of social custom and convenience

LLOYD'S FAMOUS BELL

One of the most celebrated bells in the world is the Lutine bell at Lloyd's, which is rung when a ship is missing or when a missing ship is reported safe It is now on the elaborate stand seen above

Lloyd's has assets, in the form of securities deposited by members, in excess of £10,000,000 It differs from the usual insurance company in one fundamental respect the corporation as such does not write insurance, but the risks are assumed by the underwriters individually, each of whom is personally liable for the amount of insurance he underwrites Risks of non-payment are fully safeguarded against, and large risks are distributed among many underwriters The corporation, however, makes audits of each member's accounts and, in other ways, provides a constant check to safeguard its members' interests It takes all forms of insurance except life, accepting such insurances as those against weather, chances of public or private functions being cancelled, or fog spoiling a " first night " show at a theatre In fact, Lloyd's insures against almost any contingency

Lloyd's, which is situated close to the Royal Exchange and Bank of England, is noteworthy for the traditions still preserved there Indeed, it is probably the most conservative institution in the world When, for example, a ship is posted as missing, the great Lutine bell (so called because it was recovered from the wreck of H M S La Lutine, a captured French man-o'-war that sank off the Dutch coast with a large quantity of specie on board in 1799) is rung And should an overdue vessel be reported safe the great bell clangs twice A notable occasion when the Lutine bell rang twice was when the racing yacht Endeavour I, returning from United States waters in 1937, reported " All's Well " after being missing in the Atlantic

Lloyd's was incorporated by Act of Parliament in 1871 "Lloyd's List," in which the movements of the world's shipping are reported daily, dates from 1696, and thus is the oldest newspaper in Europe with the exception of the " London Gazette "

LLOYD'S REGISTER is a British society that exists to certify the seaworthiness of ships of all kinds Its surveyors examine all ships built to its requirements and classify them in various grades, the highest being 100 A 1 at Lloyds It is controlled by a committee of shipowners and others and publishes every six months a register of ships of every class excepting those of the Royal Navy The society dates from 1834 Its head office is in Leadenhall Street London, and it has surveyors in most of the ports of Great Britain and throughout the world, for Lloyd's Register is the standard for ships of all nations

Lobster. What a curious creature the lobster is, with his powerful claws and long antennae, his eyes mounted on the ends of movable eye stalks, and his armour-like shell of deep blue covering body and tail ! Blue ? Yes, for it is only when the lobster is boiled or otherwise cooked that he turns the brilliant red which formerly caused our red-coated soldiers to be called " lobster backs "

The lobster (*Homarus gammarus*) belongs to the group Crustacea and is a big brother to the crayfish and shrimp Its tail is made up of six

Martin Duncan

LOBSTER AT REST ON THE ROCKY BOTTOM

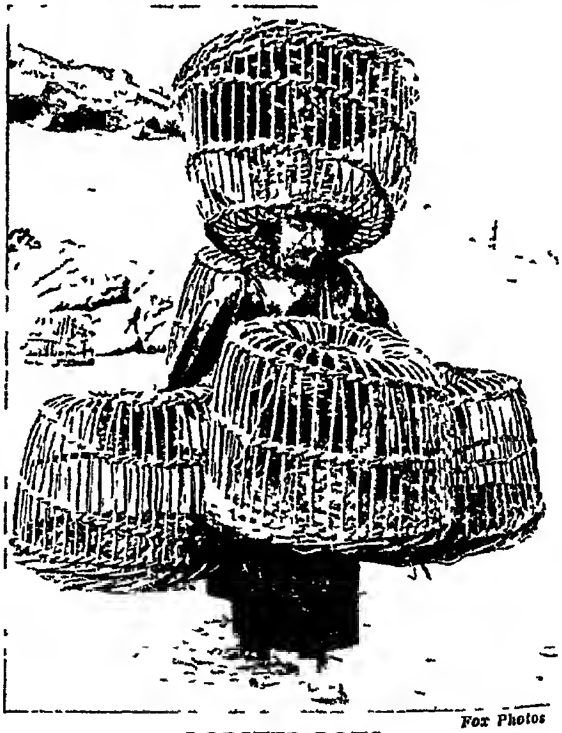
If you want to find lobsters, you must look along rocky coasts, for these big crustaceans love a rocky sea-floor on which to rest That above, indeed, is in a really typical locality, and he is crawling over the bottom with his long feelers at work, telling him what lies ahead

jointed segments, it breathes by means of many pairs of feather-like gills enclosed on each side of the body under the shell of the head and thorax, and of its two large claws the blunt-toothed one is used for crushing and the sharp-toothed one for cutting its food Behind these claws are four pairs of walking legs, the first two pairs of which end in small claws Each joint of the abdomen has a pair of "swimmerets" The last joint has expanded plates which assist the animal when it swims backwards, and this "tail" is called the "telson"

The lobster lives sometimes in shallow water near the shore and sometimes in deep water, but at all times it prefers a rocky bottom and reaches its greatest size in such places Lobsters eat living and dead animals, vegetable matter to a less extent They are well protected by their hard shells and powerful claws and by their habit of burrowing among the rocks, but when they are very small, or when they moult, as they do once a year, great numbers are destroyed by fishes, for at those times they are soft-skinned and quite helpless

The female lobster produces a great many eggs, from 3,000 to 100,000 according to her size and age These eggs are attached to the swimmerets on the under side of her tail by a sort of glue, and a female with her eggs attached is called a "berry lobster" After 11 months the eggs hatch into small larval forms, and for six to eight weeks these remain as free-swimming larvae, moulting five or six times with various changes of colour The adult form is attained when the lobster is about three-quarters of an inch long, and at this stage it sinks to the bottom near the shore and begins its lobster life As a general rule a lobster 10 to 12 inches long is about five years old Great age and size are sometimes attained, individuals weighing more than 30 lb having been found, but one of 25 lb is uncommon

The method of capture is simple A slatted box or barrel, always called a "pot," with a funnel-shaped opening of coarse netting in the ends, is baited with stale fish, weighted with a flat stone, and sunk to the bottom on a quarter-inch line This arrangement allows the lobster to enter easily, but makes it impossible for him to escape The lobster fisher has his "lobster pots" set at intervals, marked by big floating corks, and he visits them once a day to remove the lobsters and replenish the bait Some governments maintain extensive lobster hatcheries to keep lobsters from being exterminated by the fisheries, which, in America as well as in Europe, are of great extent and importance

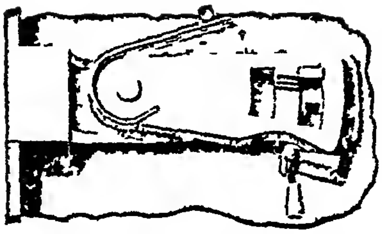


Fox Photos

LOBSTER POTS

The fishermen of Sennen Cove, Cornwall, depend mainly on lobster fishing for their livelihood This man is preparing to embark with five lobster pots They are of wicker, and when the lobster enters through the aperture in the top it cannot get out again

Besides the common lobster, the Norway lobster (*Nephrops norvegicus*) and the sea crawfish (*Palinurus vulgaris*) are the objects of organized fisheries The former is orange in colour, the latter is reddish The crawfish is especially popular in France It must not be confused with the freshwater crayfish



A TUMBLER LOCK

The spring tumblers hang on a pivot and fit over that small oblong projection from the bolt in the upper right-hand corner When the proper key is turned, the tumblers are each raised just the amount necessary to release that bolt projection Then, as the key is further revolved, it catches in the V-shaped cut in the bolt, which is just visible behind the tumblers and pushes out the bolt When the bolt projection reaches the second oblong notch at the left, the tumblers fall into place again, and the bolt is locked

Lock. Years ago canals could be made only where the surface was level, but with the invention of the lock it became possible to cut waterways even though the land round about was elevated

A lock is an artificial basin with flood-gates at each end When it is required to take a boat from high level to low level the gates at the low-level end are closed and water is poured in through sluices until the water in the basin has risen to the high-water level of the canal The high-level gates are then opened and the boat enters the basin The water in the basin is then brought to low level by emptying through the low-level gates When the water falls to that of the next low level the gates are opened, and the boat passes through (*See* Canals)

Locks and Keys Keys a foot long and weighing as much as a pound were common in the Middle Ages, and the warden of a dungeon or a castle carried at his belt a jangling weight, which in emergencies could become a terrifying weapon Such a key may be seen in use today in the Temple Church, London Yet the great locks which were opened by those giant keys were not as secure as the delicate modern locks fitted with keys that can be tucked away snugly in a waist coat pocket

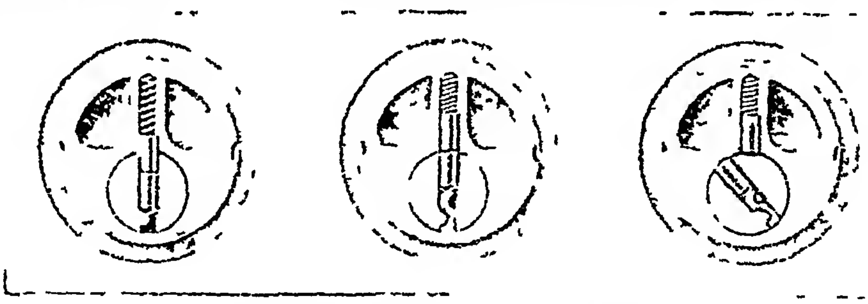
The locks of today may be divided into two general classes—warded locks, and tumbler or lever locks The warded lock has on the inside a number of projections or ridges called "wards," which prevent the turning of the key unless the grooves of the key coincide with the wards This is the type of lock used in ordinary drawers, wardrobes, desks, and so on

The tumbler lock, an improvement on the warded lock, was probably invented by the Chinese, and its fundamental principle was employed in an ancient Egyptian lock Instead of wards, this lock has small movable levers called "tumblers" This lock can be opened only by a key whose indentations raise each tumbler exactly to the proper height

It was not until the latter part of the 18th century that these locks were substantially improved upon It was then that the English Bramah lock came into use This consisted of a number of sliding tumblers contained in a tube or cylinder projecting from the lock—a construction by which it was made more secure and harder to pick than other locks

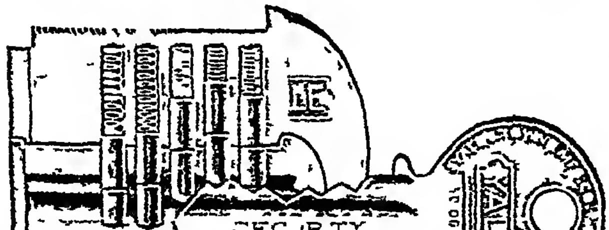
The Chubb "detector" lock was patented in 1818 This is a pivoted tumbler lock, and improved forms of it are still in wide use, especially for safes

A neat and compact lock was produced by the American inventor Linus Yale (1821–1868) who perfected his "pin-tumbler" or "cylinder" lock, universally known today as the "Yale" It is a cylinder within a cylinder It opens with a flat key, and cannot be opened by any



HOW THE 'YALE' LOCK WORKS

In the first picture we see a cross-section inside the lock showing how the smaller cylinder fitting within the larger cylinder is kept from revolving by a "pin-tumbler," which is thrust down by a tiny coiled spring This pin-tumbler is cut in two near the middle In the next picture we see what happens when the key is inserted—the pin-tumbler is raised until the "cut" comes at the junction point of the two cylinders This permits the inner cylinder to revolve, as shown in the third picture



Here we see the cylinder lock from the side, and cut away to show the mechanism This is a "five-tumbler" lock, each tumbler working like the one described in the first pictures As the key goes in, the tumblers are pushed up by the wedge-shaped point When the key is all the way in, if it is the proper key, the five tumblers will all rest in its notches in such a way that the tumbler cuts are all directly in line with the cylinder division, and the inner cylinder can turn and pull back the bolt

key differing from the true key by even so little as one-fiftieth of an inch in the height of any notch

But even the best of key locks can be opened either with a skeleton key—a key with most of its blades cut away to avoid all the wards—or with some other device of the burglar or the expert lock-picker, and it remained for Yale to invent the keyless dial or combination lock now so widely used for safes and vaults This lock is operated by a knob which is turned backwards and forwards certain "combinations" of distances known only to the proper persons The rotation of the knob, of course, merely sets the wheels or tumblers in the mechanism of the lock so that it will slip open

Finally, improvements on the combination lock brought forth, in 1857, the greatest lock of all—the time lock, in which a timepiece is set with the lock, and the clockwork operates the mechanism Thus the lock can only be opened at a certain time

WONDERS *of the* RAILWAY ENGINE

Here is told the amazing story of the growth of the locomotive from "Puffing Billy" and the "Rocket" to the "Coronation Scot" The principal parts of the engine and how they work are also described

Locomotive. Like all great inventions, the locomotive ("a machine that can move from place to place") developed through the slow accumulation of improvements made by different inventors Men in England and France were working on the idea as early as the middle of the 18th century Some "locos" were designed to run on the ordinary highways, and were forerunners of the motor-car Richard Trevithick, in England, about 1802, was the first to make a steam-driven engine which travelled on rails, but only at the rate of five miles an hour William Hedley improved on this (1813) with his "Puffing Billy," so called from the noise which it made

Name-plate of a locomotive of the "Silver Jubilee" class
Photo E R Wethersett

The first really successful locomotive, however, was the work of George Stephenson (*q v*), and was used to haul coal for the Killingworth colliery (Northumberland) in 1814 In 1825, at the opening of the Stockton and Darlington railway—a line measuring 37 miles—a Stephenson engine weighing eight tons and capable of 16 miles per hour was used Of the early locomotives, the "Rocket," produced by George and Robert Stephenson, was perhaps the most famous At the competitive trial of locomotives held at Rainhill, Lancs, in 1829, this engine showed a speed of from 24 to 29 miles per hour

These early locomotives were pygmies compared with the heavy, fast, and powerful machines of today Speeds exceeding even 100 miles per hour have been recently achieved by express locomotives, the British record of 125 m p h ("Mallard") at present standing to the credit of the London & North Eastern Railway A typical British express locomotive weighs over 150 tons and can haul 500 tons at an average speed of 60 m p h or more

Although the modern steam locomotive is not a very economical form of steam generator, from the point of view of the use of fuel, in a country like Great Britain, where water power is not available to produce cheap electricity, it is the most economical motive power, except on lines which carry very heavy traffic

It is, however, expensive, and continual attempts are being made to reduce the cost of construction and maintenance and to add to its efficiency But, although some of these have been partially successful, the fact remains that the general design of the locomotive of today has not been greatly altered since the adoption of the standard gauge for our railways The biggest change is in the direction of "streamlining," whereby wind resistance is reduced to a minimum

Components of a Locomotive

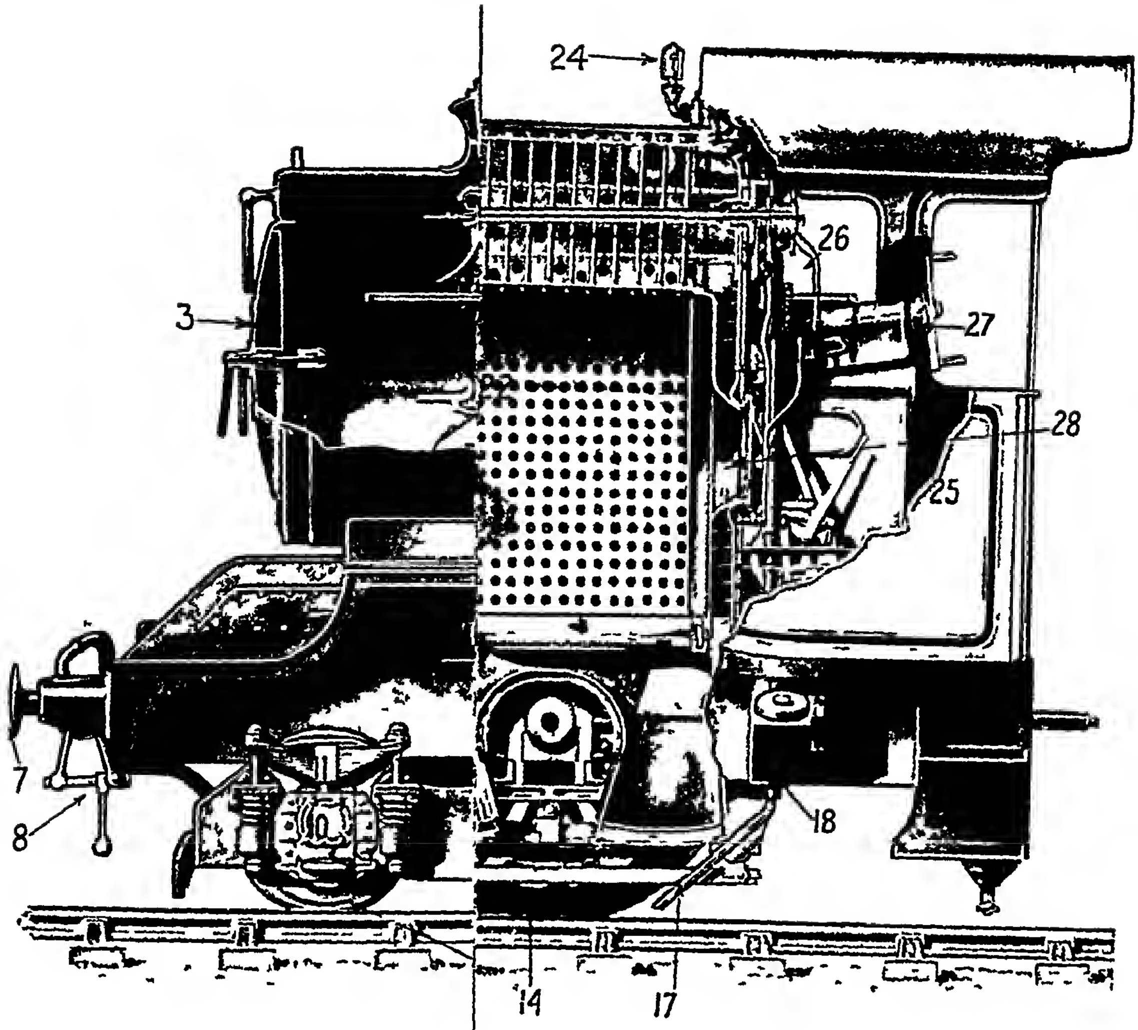
The principal parts of the steam locomotive are —1 The boiler, including the boiler barrel and fire box, and also the smoke box, ash pan, and other portions connected with the generation of the steam

2 The engine, which includes the cylinders, pistons and piston rods, connecting rods and cranks, also the valves, valve gear, and reversing apparatus

3 The frame on which the boiler is mounted and to which the cylinders and other working parts are attached, the wheels, four, six or eight in number, two or four of which are revolved by the cylinders, and the bogie, a four-wheeled truck which carries the front part of the engine

4 The tender, or, in the case of tank engines, the tanks and coal bunkers which carry the supplies of fuel and water

The boiler consists of four main portions—the inner fire box, the outer fire box or shell, the



HOW A GIAN
EXPRESS LOC

THIS diagram shows the chief workin
of the "King" class, so called bec
England Locomotives of this type hau
on the Great Western, including such f
and the Torbay Express They have fo
the inside cylinders driving the first pair o
pair The valve gear which controls t
cylinders is inside the frame The engine

1 Chimney
2 Smoke box which collects the smoke and ashes drawn through the tubes from the fire box the smoke being discharged through the chimney
3 Smoke box door
4 Blast pipe through which the discharge of steam from the cylinders is carried into the smoke box
5 Regulator valve through which steam is admitted to the cylinders
6 Steam chest through which the steam enters the cylinders
7 Buffer
8 Screw coupling
9 Bogie wheels
10 Outside axle bearing for bogie
11 Bogie spring
12 Leading
necte
13 Driving
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14 Trailing
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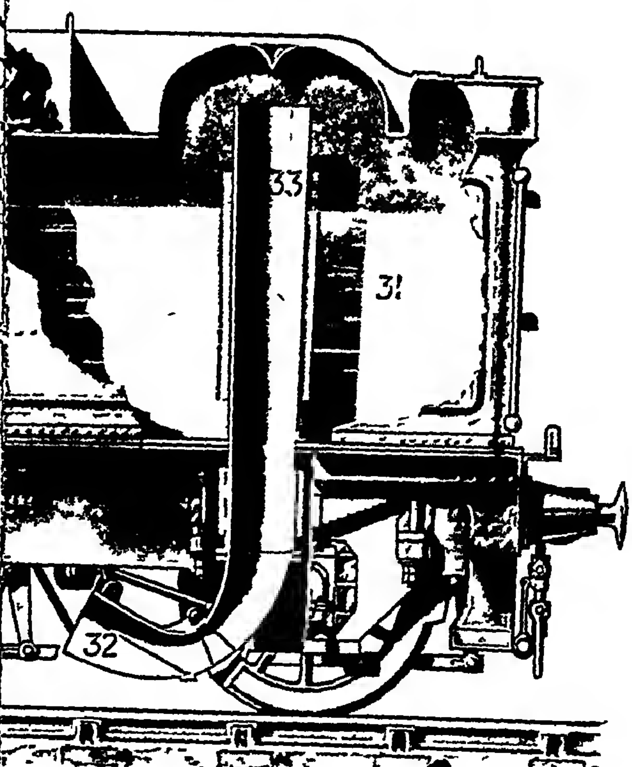
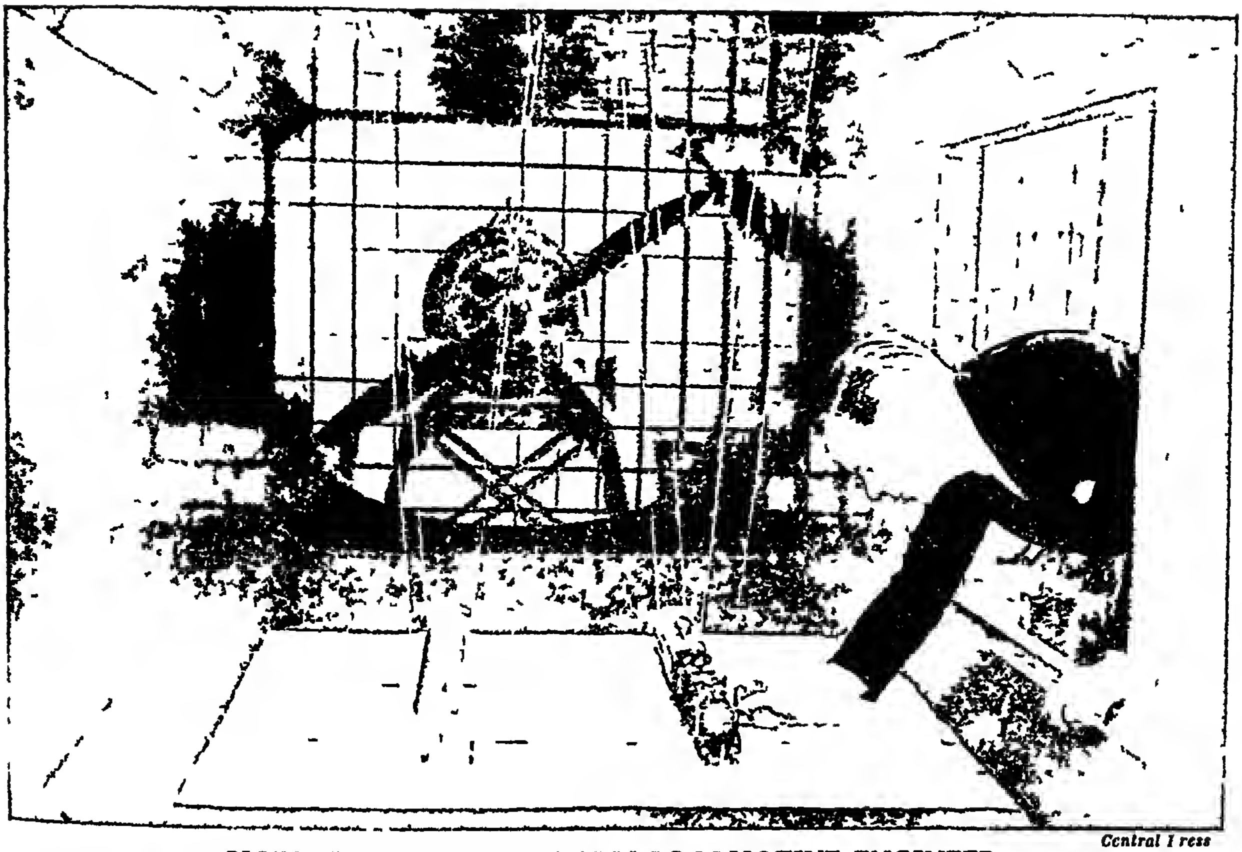




Central Press

MODELS USED TO HELP THE LOCOMOTIVE ENGINEER

To the aid of the designer of locomotives science has now brought many appliances which only a few years ago were undreamt of One of these is the wind tunnel to test the resistance of a locomotive to the air The one employed at the London Midland and Scottish locomotive works at Derby is seen here At the end of the tunnel is an electric fan which creates a great current of air while two model locomotives and coaches one streamlined, the other of the ordinary type, are tested in the artificial gale

barrel containing the tubes, and the smoke box In the inner fire box the fire is placed, and the heated gases from it are conducted through a large number of tubes or flues—heating in their passage the water surrounding the tubes—to the smoke box at the other end, and thence to the chimney The smoke box also contains the blast pipe, out of which the exhaust steam from the cylinders issues

With the number of tubes employed in the boiler—usually from 200 to 250—the heating surface in contact with water is very large, but even then, to make sufficient steam to keep the engine supplied, it is necessary to urge the fire artificially to increase the rate of combustion Every stroke of the piston sends a discharge of steam through the blast pipe up the chimney, withdrawing a percentage of the contents of the smoke box with it and leaving a partial vacuum in that chamber, and thus to destroy this atmospheric air rushes through the fire from beneath, producing the rapid combustion desired The typical express locomotive already mentioned has a boiler 18 feet long, a heating surface of 3,326 sq feet, and a working pressure of 250 lb per sq in

Take next the engine, or mechanism by means of which the energy of the steam is transformed into useful work by propelling itself and its load Primarily, the engine consists of the cylinders, in which the steam acts on the pistons, whose reciprocating motion is transformed through the medium of the piston and connecting rods into a rotary one at the crank axle, propelling the engine either backwards or forwards, as required

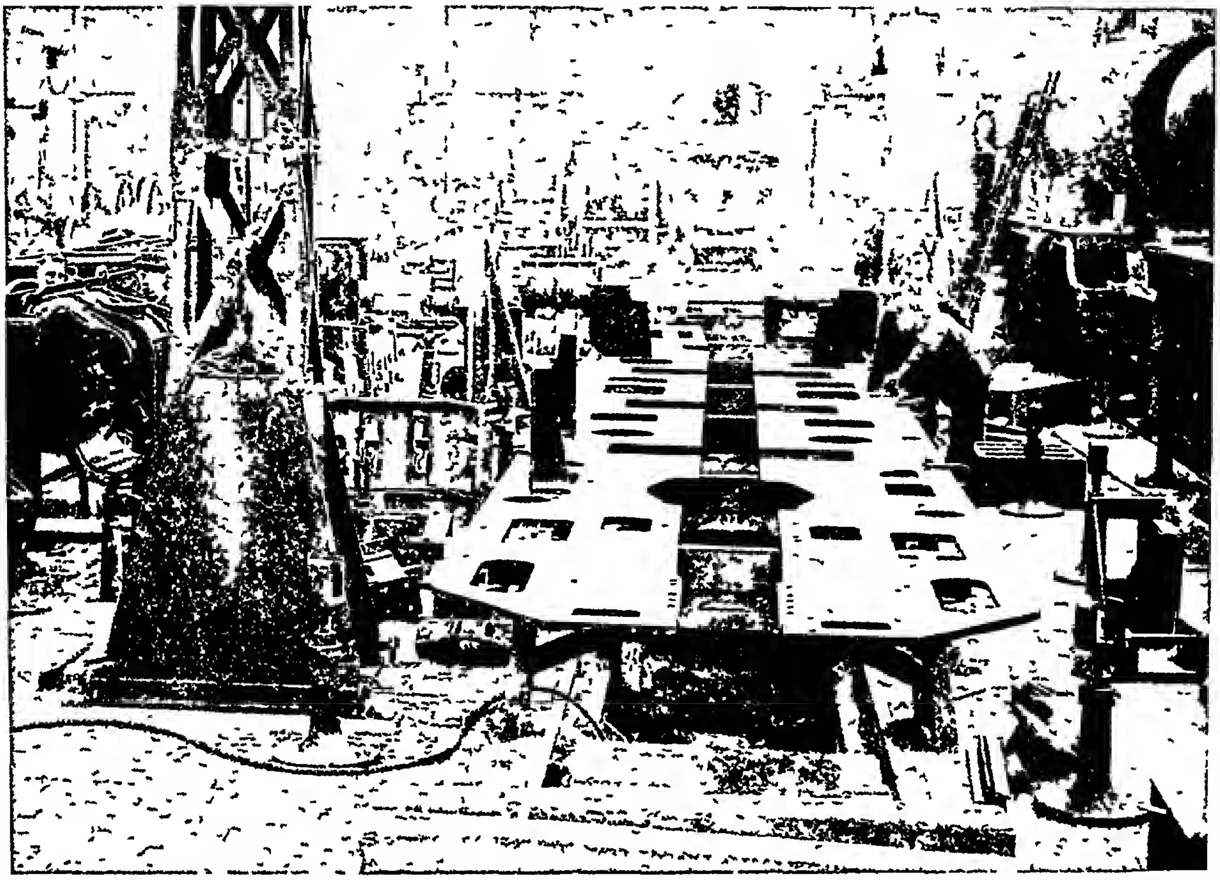
If there are two cylinders, there are, of course, two cranks These are set at an angle of 90 degrees to each other, so that when one piston is at the end of its stroke, or on the dead centre, the other is in its position of maximum effort Three- or even four-cylinder locomotives, it may be noted, are now common on British main lines

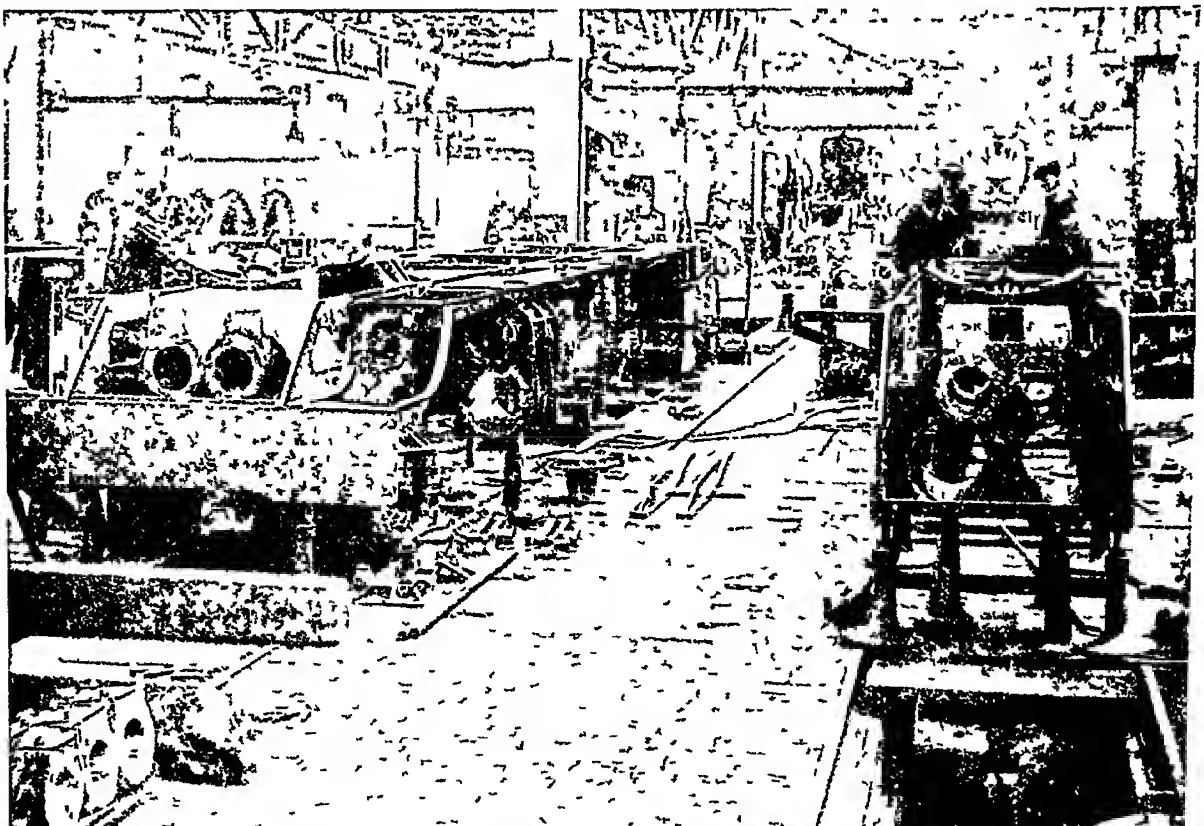
Steam is admitted alternately on opposite sides of the piston through two steam ports, one at each end of the cylinder, leading from the steam chest A third port—the exhaust port—allows the steam to escape to the blast pipe

These ports are opened and closed by a valve in which a piston moves backwards and forwards The piston valve is enclosed in the steam chest into which steam passes from the boiler by the main steam pipe The movement to the valves is imparted by eccentrics and link motion, which serves as a reversing gear

There are several forms of valve gear, the principal being Stephenson's shifting link

AT THE BIRTH OF AN EXPRESS LOCOMOTIVE

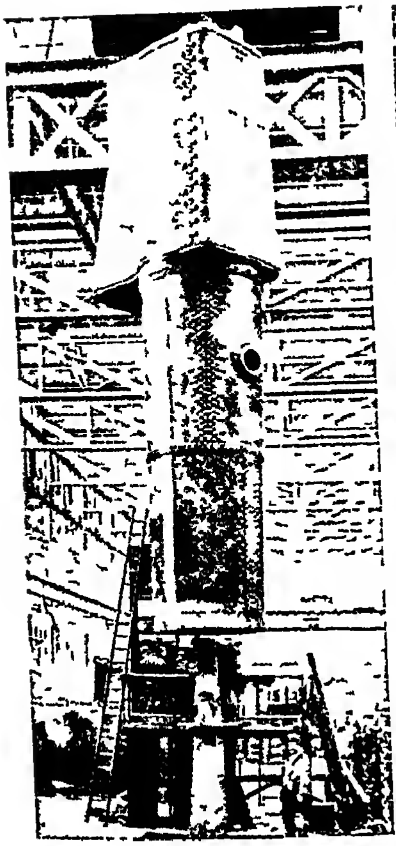


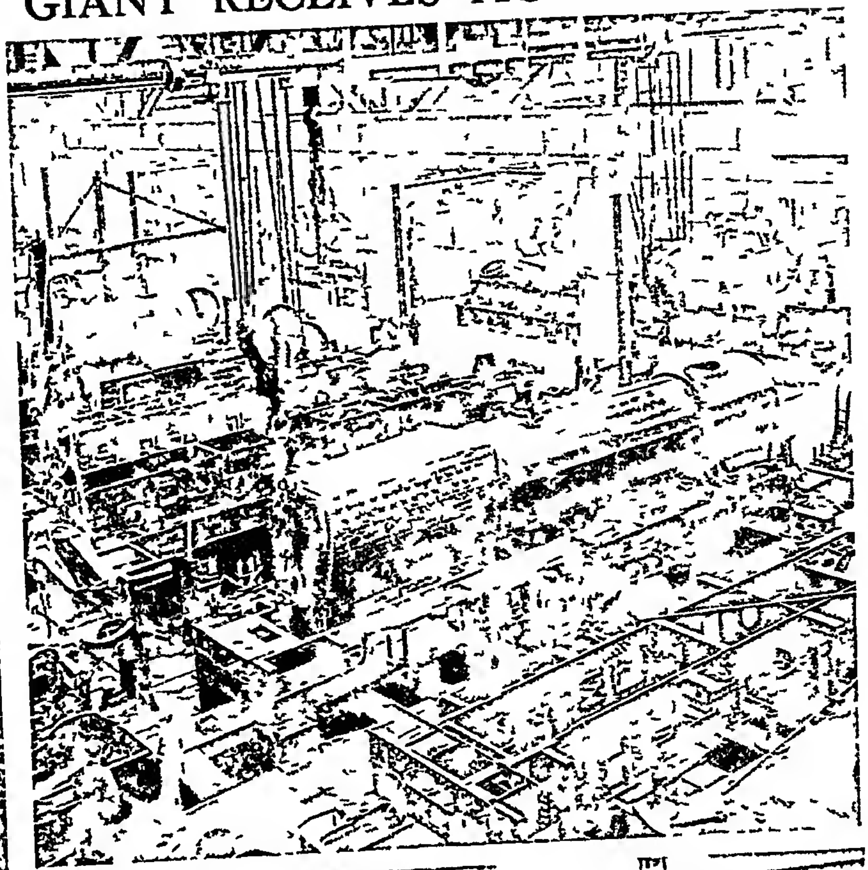


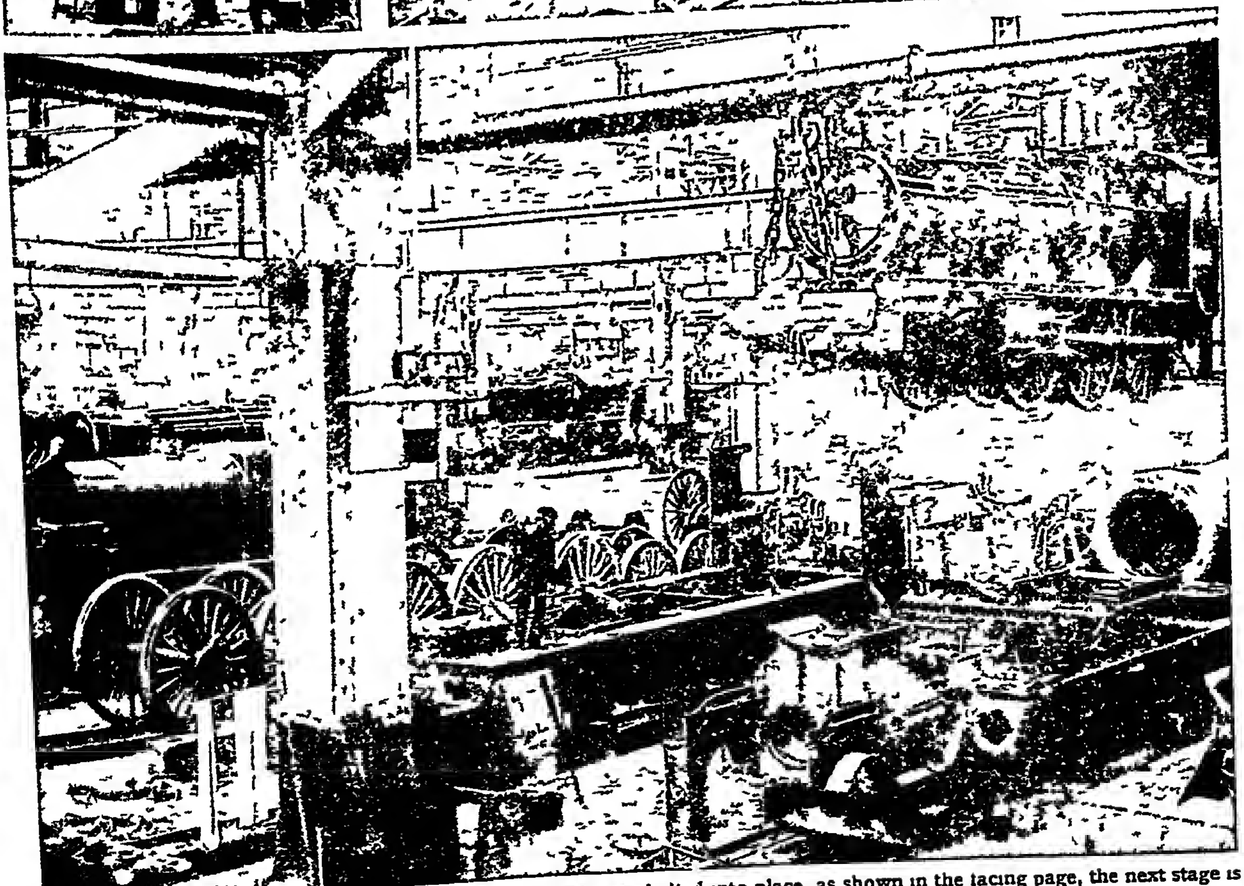
The preliminary stages in the building of a locomotive are shown in these two photographs, both taken in the Swindon works of the Great Western Railway In that at the top the framework of an express engine of the King George V type is being laid down The lower photograph shows a further stage in the process of erection Facing the camera is a pair of inside cylinders, mounted between the frames of a four-cylinder engine The boiler will rest on the curved saddle seen above the cylinders On the left a similar locomotive has the outside cylinders bolted on to the frame

Courtesy of Great Western Railway

A RAILWAY GIANT RECEIVES ITS BOILER

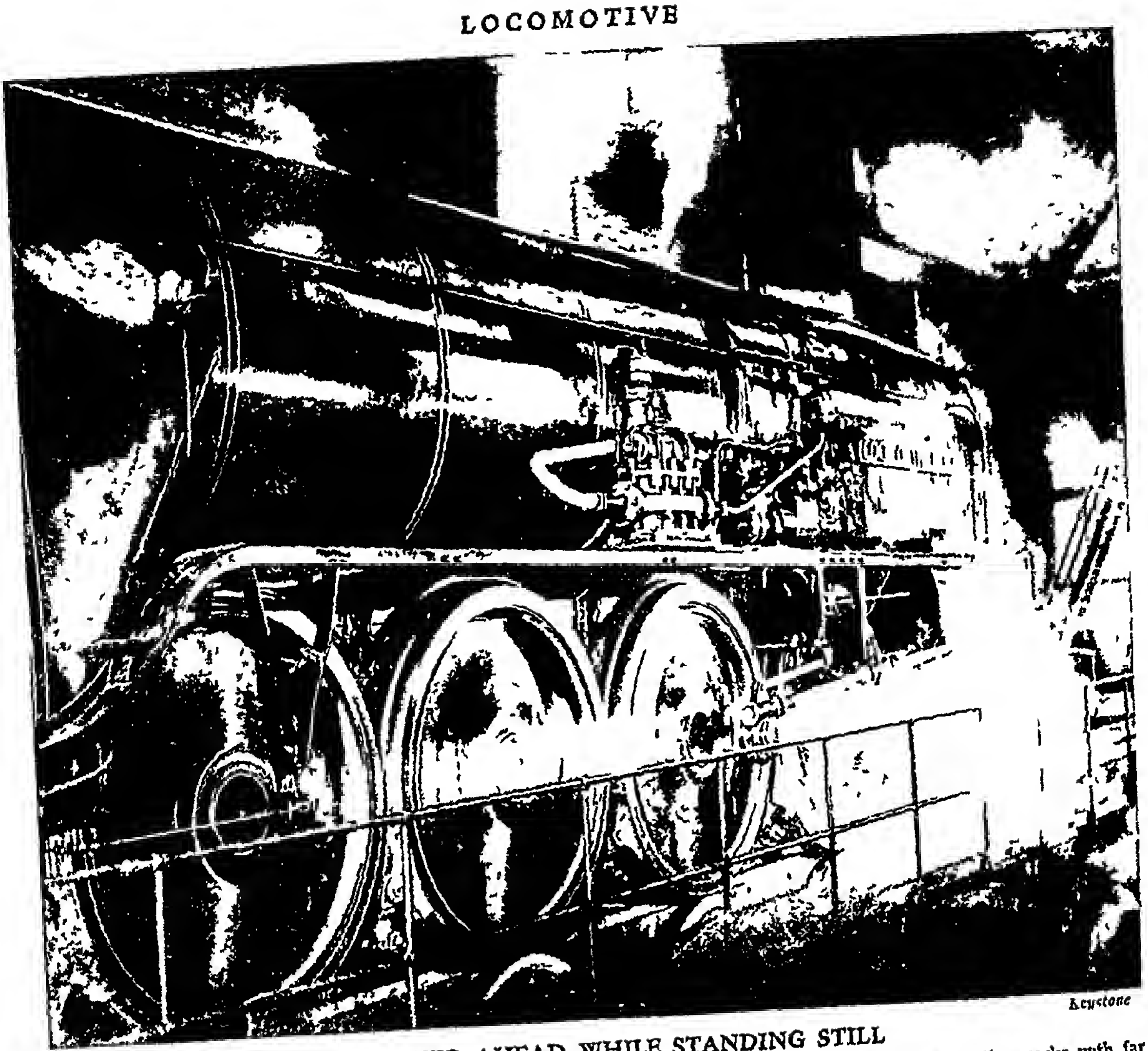






When the framework is in position and the cylinders have been bolted into place, as shown in the facing page, the next stage is to put the boiler in position Travelling cranes convey the huge structure from one point to another, and in the photograph, top left, it is seen held front downwards over a riveting machine In the top right photograph the completed boiler has just been lowered into position on the frame In the centre of the lower photograph is seen an array of pairs of wheels on to two or three of which frame and boiler will be lowered

Courtesy of Great Western Railway



Keystone

FULL SPEED AHEAD WHILE STANDING STILL

It is no longer necessary to run a locomotive on rails to test its efficiency, for this can now be done in the works with far greater accuracy The engine is mounted on circular disks instead of rails, and on these the wheels can revolve freely while the engine is stationary The resistance of the disks can be regulated to represent varying loads and gradients, while elaborate mechanism registers the horse power developed, the fuel consumption, and other facts useful to the designer

motion, Gooch's stationary link motion, Allan's straight link motion, Joy's radial valve gear, and Walschaerts' valve gear

The Stephenson, or "shifting link," motion was introduced in 1843, and has been commonly used to this day for locomotives It is, however, being gradually supplanted, especially in outside cylinder engines, by Walschaerts' gear

In the Stephenson motion there are two eccentrics connected to a slotted link, this link is curved, the radius of curvature being that of the eccentric rod It is capable of being raised or lowered by a lever operated by the driver, and accommodates in its slotted portion a block which slides in the slot, and this is connected directly with the valve by a rod Therefore, in the mid-position, the valve is not moved by either eccentric As the block occupies the top or bottom position of the link, it is brought under the influence of either eccentric, and the valve travels its full distance The extreme positions serve to determine the direction in which the engine will run, backward or forward

Walschaerts' valve gear has one eccentric and a slot link, and takes its valve movements mainly from the crosshead It produces a more uniform steam distribution than the Stephenson gear

Having described the engine, we have next to consider the framing and running gear The engine and boiler are arranged and carried on a framing supported by the wheels and axles In this country the frames are usually built up of plates, the two inner ones inside the wheels being the main frames, and the two outer ones supporting the footplates, splashers, etc

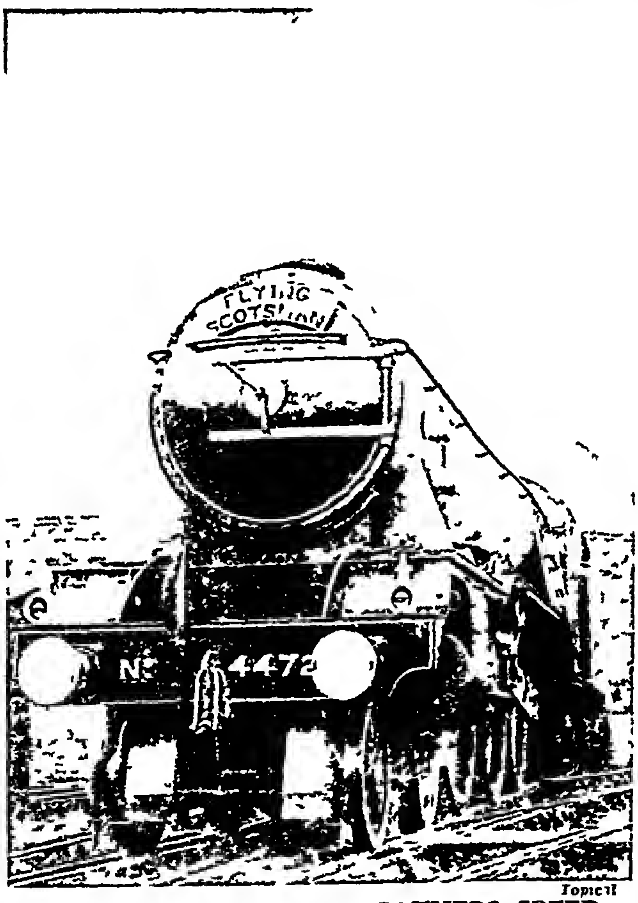
The main frames are arranged vertically, and have to be connected to each other to give them sufficient lateral stiffness and maintain them at the proper distance apart They are merely strong steel plates, shaped to take the axles of the wheels, and drilled for attachment of the engine details Firmly bolted to the frames and fitted into the horns are the steel horn blocks, having rectangular faces inside which the axle boxes can ride up and down freely

The connexions of the springs to the frames are by brackets riveted on each side of the axles, in which there are holes for the spring hangers to pass through. The hangers are pinned to the top ends of the springs, and are secured below the brackets by strong double nuts, sometimes with rubber washers between. The springs lessen the shocks received by the wheels when running, and are of several forms.

Spiral springs are generally used for the driving wheels, and laminated, or plate, springs for the carrying wheels. The greater part of the engine is spring-borne; that is, the weight is first conveyed through the brackets to the large nuts beneath them; the nuts transmit the weight to the spring hangers, so that there is a pull at the top-end pins on each side of the spring, which deflect according to the load.

There is an important part of the engine which is not spring-borne. This consists of the wheels and axles themselves, and the driving axle, with the eccentrics and cranks, which really form part of it. Consequently, these details should be made as light as possible, consistent with strength. The wheel centres are now usually cast steel, with rolled steel tires shrunk on. Axles also are of steel with portions at each end carefully turned to form the wheel seats, which are pressed hydraulically into the wheel centres. Crank axles are rather complicated forgings formed to take the ends of the two connecting rods.

The leading end of express engines is often carried on a separate four-wheeled truck or bogie. Connexion between the main frame of the engine and this bogie is made by a centre pivot and pin, about which the bogies can swivel, as the frame of this is quite separate from the main frame. Besides serving to distribute the heavy weight at the front end of the engine, the bogie gives lateral flexibility on curves. Radiating trucks, however, are sometimes made with one pair of wheels only.



Topical

'FLYING SCOTSMAN' GATHERS SPEED

This photograph shows the Flying Scotsman leaving King's Cross Station on its journey north. The locomotive is the latest type of Pacific engine, which was the most powerful on the L N E R before the streamlined 'Silver Jubilee' engines

Buffer and draw gear next claim our attention. The side buffers, with which all standard gauge engines in this country are provided, are attached to the buffer beam arranged to meet those of the vehicles forming the train. A common form of buffer comprises a hollow plunger fitting easily in a casing. Within the plunger are a block of hard wood and a coiled steel spring, a central pin passes through a hole in the base plate, and after the whole has received an initial compression it is secured by a cotter behind the back plate. There are many other designs in use.

The drawhook has a shank, which passes through the buffer beam at its centre and pulls on to steel springs. Through a hole in the hook a link of the shackle of the screw coupling is passed, a swivel being attached to the two ends of the shackle securing them and the screw together. The screw is revolved by means of the hanging arm and turns in a nut fixed to the other link of the shackle; this second link is hooked on to the next vehicle, and as the screw is turned, the necessary tension is secured, whilst the weight hanging down prevents the screw from slacking.

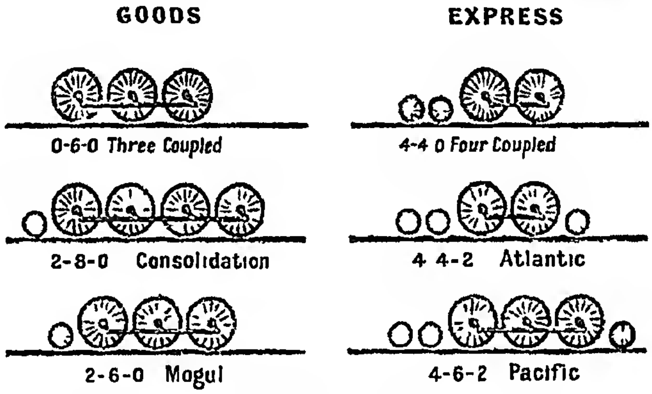
With the space at our disposal, we can only briefly consider some of the miscellaneous fittings necessary for the running equipment of the locomotive. The adhesion, or resistance, to slipping of the wheels is dependent on the weight placed on the drivers but qualified by the condition of the rails. In order to work under the most advantageous conditions on wet or greasy rails, and obtain as much adhesion as possible, it is necessary to fit sanding gear upon the engines, operated by steam or compressed air, for allowing sand to run upon the rails.

In concluding the reference to running gear, that very necessary item lubrication should be mentioned. When the part to be lubricated has no movement apart from the whole movement of the engine, such as slide bars, axle boxes, etc.,

the oil is siphoned by worsted trimmings fed from the oil reservoir by capillary attraction Parts which are subject to violent movement, such as eccentric straps, etc, are fitted with "plug" cups and trimmings, which are made by forming a loop of copper wire and wrapping strands of worsted round it, then pushing the whole into the oil hole As the oil is thrown about by the movement of the part to which it is fixed, some of the oil in the reservoir above the plug passes through it to the bearing

The brake gear may be arranged to work by hand or power, but in all passenger engines, and most goods engines, power is used (*See* Brakes) The power may be obtained from (1) compressed air, (2) atmospheric pressure, as in the vacuum brake, or (3) steam On engines for heavy service it is customary to fit all the wheels of both engine and tender with brakes

A brake cylinder and piston are fixed beneath the foot-plate, and the end of the piston rod is connected to a bent lever, which has an arm attached to a cross shaft, the other end of the lever being connected to the end of one of the brake rods When air or steam is admitted to the brake cylinder, the rods are pulled, and with them a series of cross beam-levers, forcing the blocks hard against the wheels



LOCOMOTIVE WHEEL ARRANGEMENTS
This diagram shows the wheel arrangements now most generally used on British railways In the case of engines of the "Pacific" type the trailer wheel is not always fitted, as in the case of the King George V class on the G W R

Engines intended for short runs are often provided with tanks for water and coal bunkers upon their own frames Wash plates are provided in these tanks to prevent the water from washing from one end to the other when the brakes are applied Sometimes these tanks are made semicircular in shape to fit on top of the boiler—these are called "saddle" tanks Tank engines have the advantage of being able to run equally well in either direction

Tenders on standard British locomotives are constructed to carry up to 5,000 gallons of water and nine tons of coal, and usually run on six or eight wheels, spaced equally The coal space is above the tank and made with a sloping bottom, so that there is a tendency for the coal to shake forward towards the door, thus being convenient for the fireman Water pick-up arrangements are now fitted to most tenders

A modern development, as applied to nearly all locomotive engines, is the adoption of superheated steam The principle is very simple—to raise the temperature of the steam before it is admitted to the cylinders Passing mention may also be made of the application of compounding to locomotives In a compound engine, the steam in passing through one (high-pressure) cylinder expands only partially, and is then exhausted into the larger low-pressure cylinder or cylinders, in which expansion is completed, and finally exhausts into the air

Classification of Locomotives

Locomotives are usually classified according to their wheel arrangement—giving, in order, the number of "idle" wheels in front, of main coupled driving wheels, and of idle trailing wheels An outstanding class is the 4-6-2 or "Pacific" This includes many of the finest locomotives in Britain, such as the fine streamlined "Coronation Scot" and the "Princess Elizabeth" of the L M S, and the streamlined "Coronation" and "Silver Jubilee" and long-famous "Flying Scotsman" of the L N E R No 6202 of the L M S—Britain's only turbine locomotive—is also a "Pacific"

The 4-6-0's—*i e*, locomotives with a leading four-wheeled bogie and six coupled wheels—include the "Royal Scots" of the L M S, "Castles" and "Kings" of the G W R, and "Lord Nelsons" and "King Arthurs" of the S R Other notable wheel arrangements are the 4-4-0 (*e g* the S R "Schools" class), 4-4-2 or "Atlantic," and, for hauling particularly heavy "mixed" or goods trains, the 2-6-0 ("Mogul") and 2-8-2 ("Mikado") The locomotive with the greatest number of wheels (if one excepts articulated types like the gigantic Beyer-Garratt) is probably a 4-14-4 that was built in Russia in 1935

There are, of course, a great variety of electric, petrol, and Diesel (oil)-engined locomotives in regular and successful use Electric traction is popular in such countries as Austria and Switzerland while the Diesel-operated "railcar" is highly developed on the German state railways, and holds, in fact, many of the world's speed records for any type of locomotive

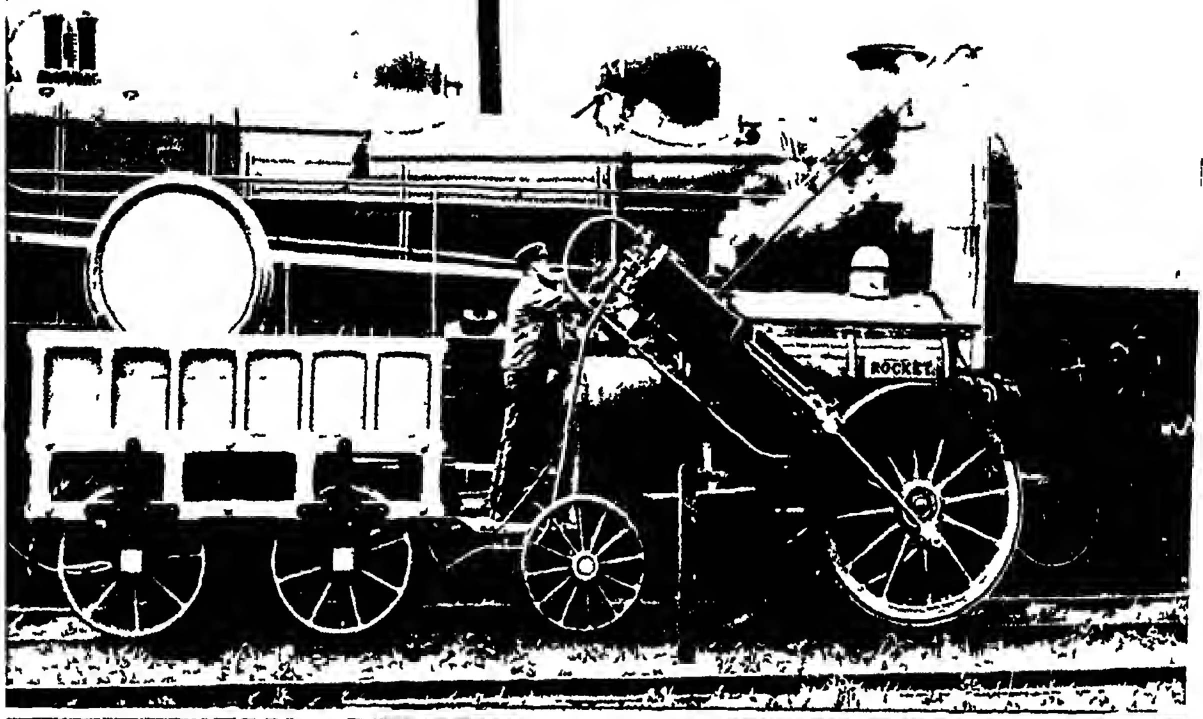
The long-distance railways of the United States and Canada, with their wider loading gauge, demand engines that are, generally speaking, much larger than comparable designs in Britain The provision of such equipment as cow-catchers and bell on the front, and the fitting of much of the auxiliary gear externally, also appear strange to British eyes

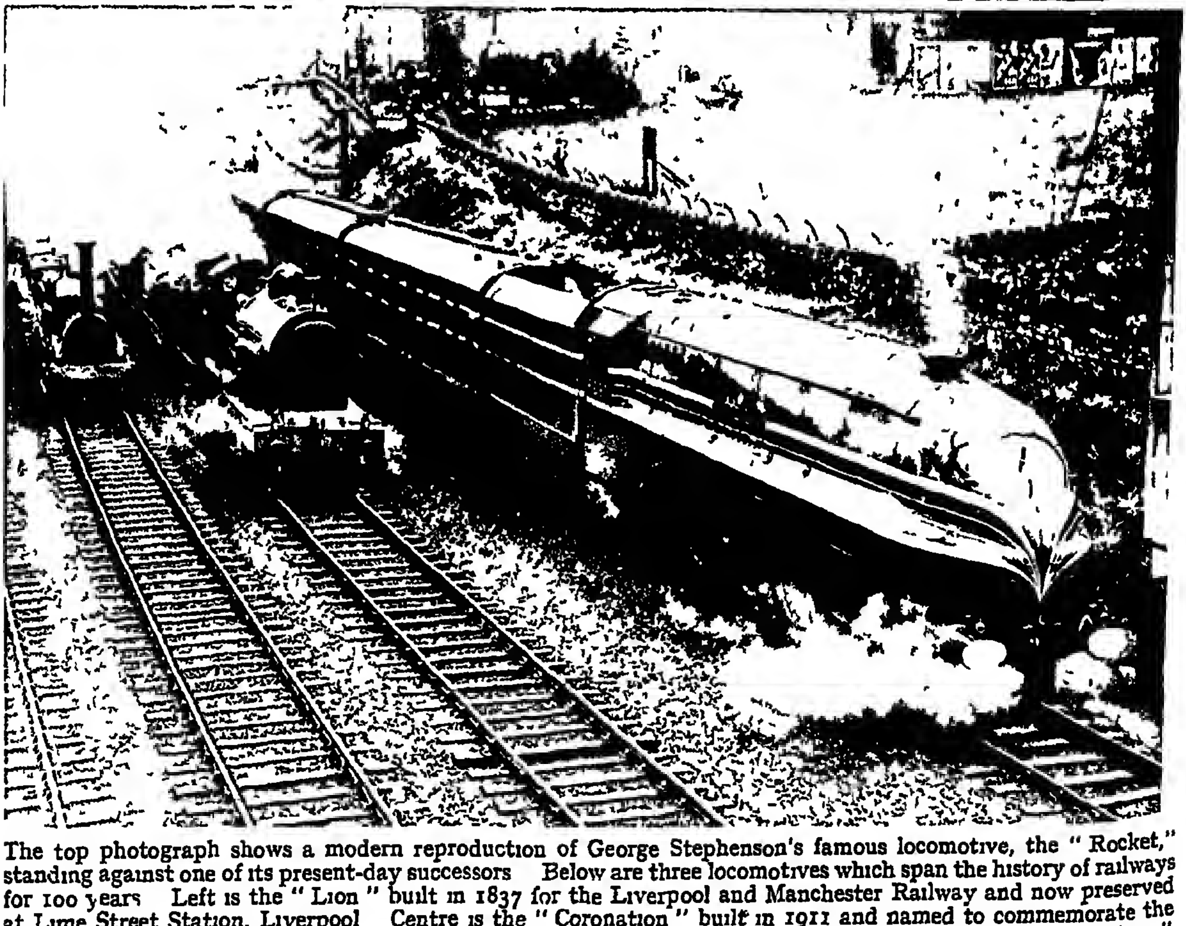
MONARCHS OF THE STEEL HIGHWAY

Topical

It is not only for children that a locomotive has fascination for many a grown-up passenger walks up the platform before the train starts to look at the huge machine which is to take him on his journey This photograph, taken at Euston Station the terminus of the London Midland and Scottish Railway shows two little girls who evidently share a boy s love of engines for they too, are enthralled by the giant of the iron road and have been lucky enough to get a word or two with the driver

A HUNDRED YEARS OF LOCOMOTIVE PROGRESS

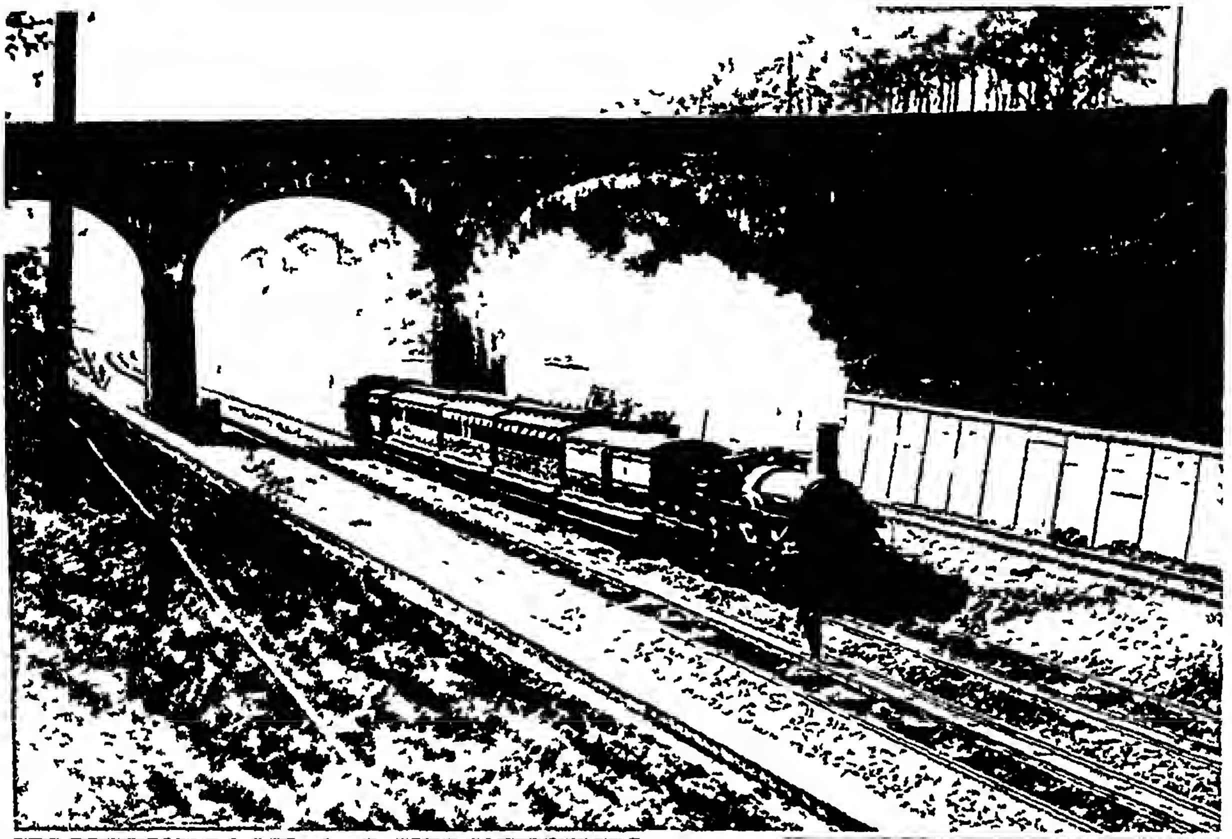




The top photograph shows a modern reproduction of George Stephenson's famous locomotive, the " Rocket," standing against one of its present-day successors Below are three locomotives which span the history of railways for 100 years Left is the " Lion " built in 1837 for the Liverpool and Manchester Railway and now preserved at Lime Street Station, Liverpool Centre is the " Coronation " built in 1911 and named to commemorate the Coronation of King George V Right is the London Midland and Scottish streamlined locomotive " Coronation," built in 1937 and representing the latest departure in locomotive design

Photos top Photopress lower Fox Photos

BROAD GAUGE & NARROW GAUGE OF THE G.W.R.



The Great Western Railway was originally built with a gauge of 7 feet, whereas all other railways had a gauge of 4 feet 8½ inches In the early 'nineties however the Great Western decided to abandon the broad gauge and conform to that of other lines The top photograph shows the last broad gauge train passing through the Sonning cutting on May 23, 1892 Below is a modern express train, the famous " Cheltenham Flier " on its run to London travelling on the narrow gauge lines which are now universal in Great Britain and are in general use in most Continental countries and on the chief lines of the United States and Canada

Courtesy of Great Western Railway

SIX 'KINGS' SPICK AND SPAN FOR A DAY'S RUN

Topical

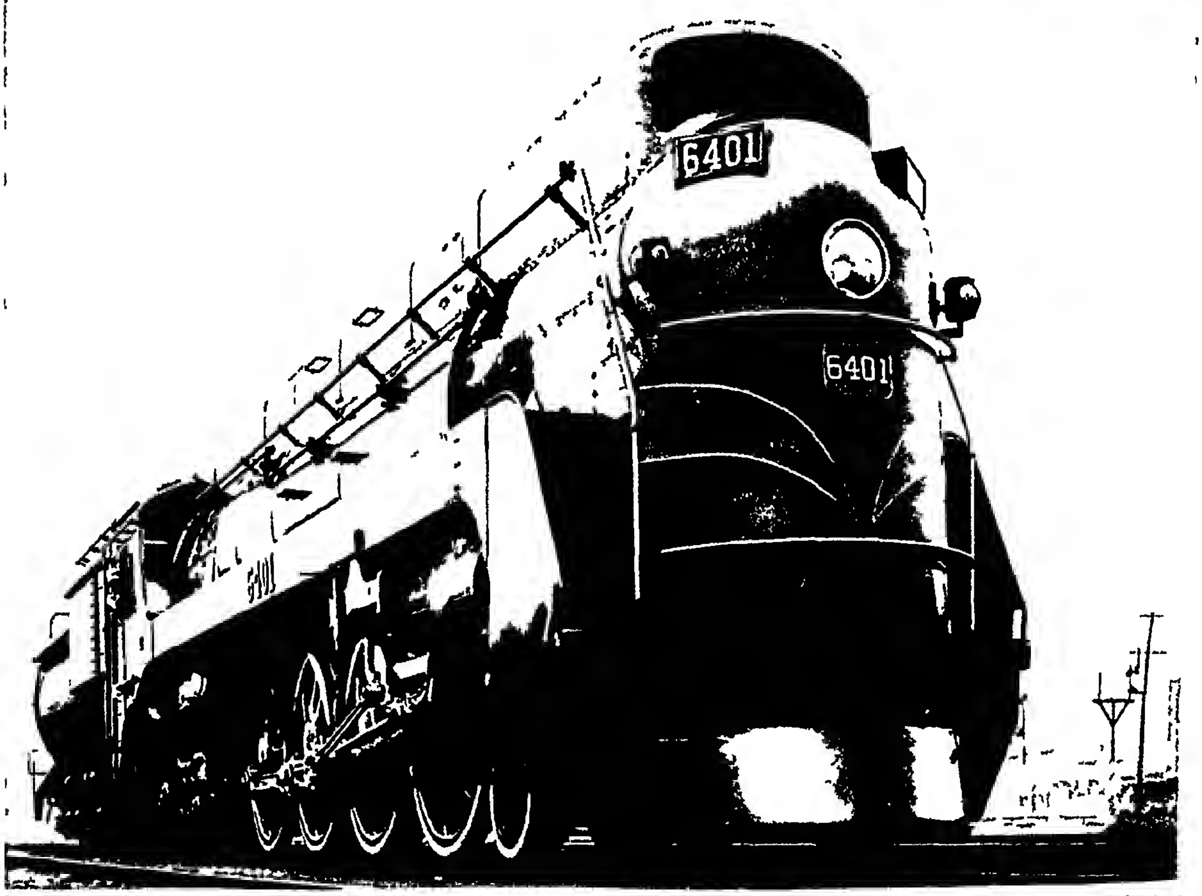
When a train arrives at the end of its journey, or when locomotives are changed during the run of a long-distance express, the engine is taken to the sheds to prepare it for the next day's work This photograph shows a row of engines of the "King" class on the Great Western Railway just after leaving the sheds The furnace has been re-lit and steam is up, while the paint and brass work have been polished till they shine again The tender has been filled up with coal and water, and one by one these engines will back on to the trains they are to haul.

STREAMLINED GIANTS IN THEIR SILVER ARMOUR

Fox Photos

The three locomotives on the left of this photograph are all "streamlined", that is to say the boiler and all the working parts are encased in an outer covering designed to offer the least possible resistance to the air They are employed in drawing the fastest long-distance trains on the London and North Eastern Railway The first one began to run in 1935 the year of the Silver Jubilee of King George V and was named 'Silver Jubilee' The names of all the engines of this class include the word "silver" others being 'Silver Fox" and "Silver Link"

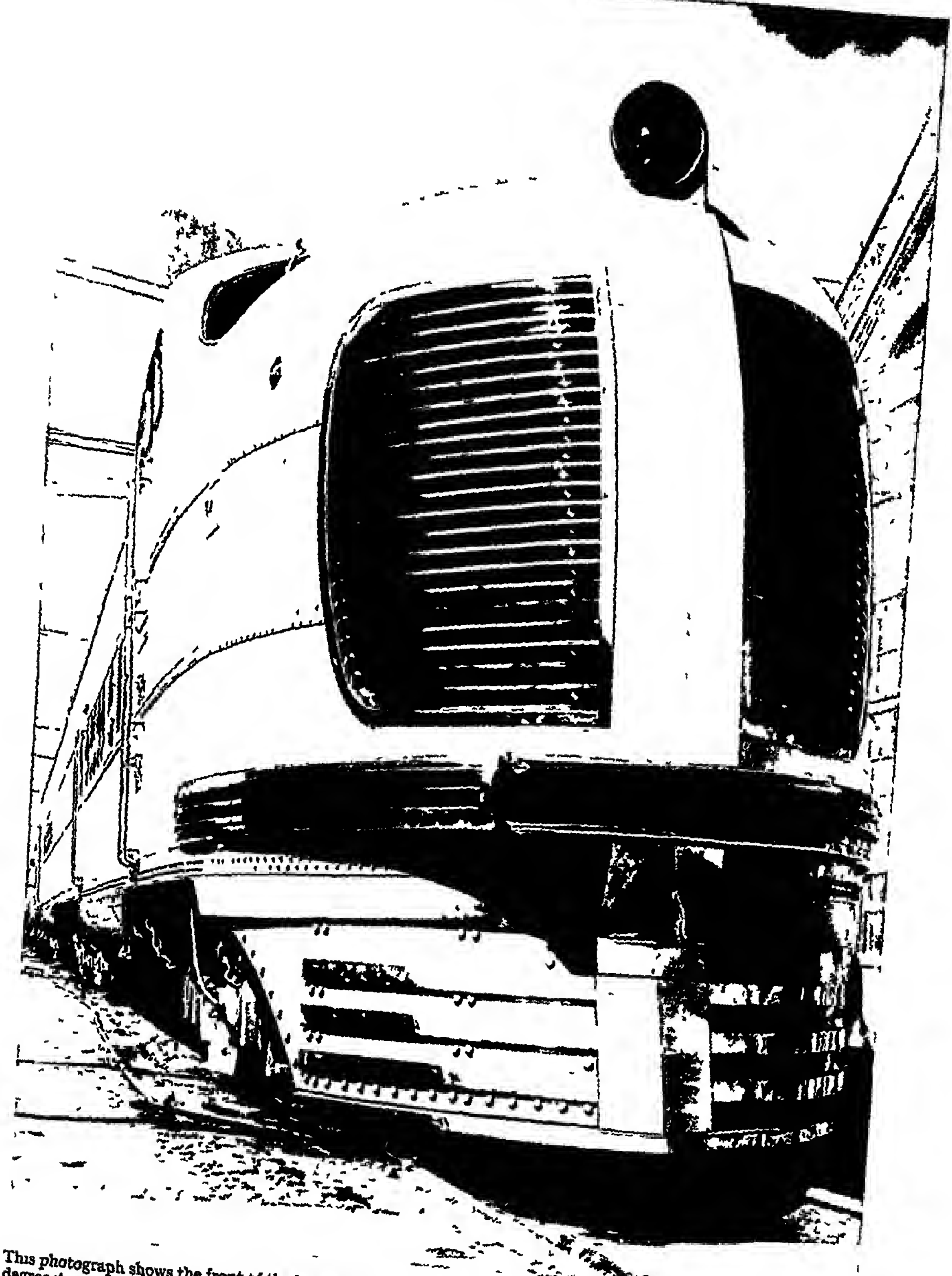
ENGINES OF POWER & SPEED ON TWO CONTINENTS



The photographs in this page show two of the most powerful locomotives in the world. The top one is an electric locomotive of the Swiss Federal Railways used for hauling the heaviest trains over steep gradients. The Swiss Railways have been almost entirely electrified, for Switzerland has an abundance of water power and electricity can be generated cheaply. The lower photograph shows the latest semi-streamlined locomotive of the Canadian Pacific Railway. This engine is capable of a speed of 100 miles per hour

Courtesy of Swiss Federal Railways and Canadian National Railways

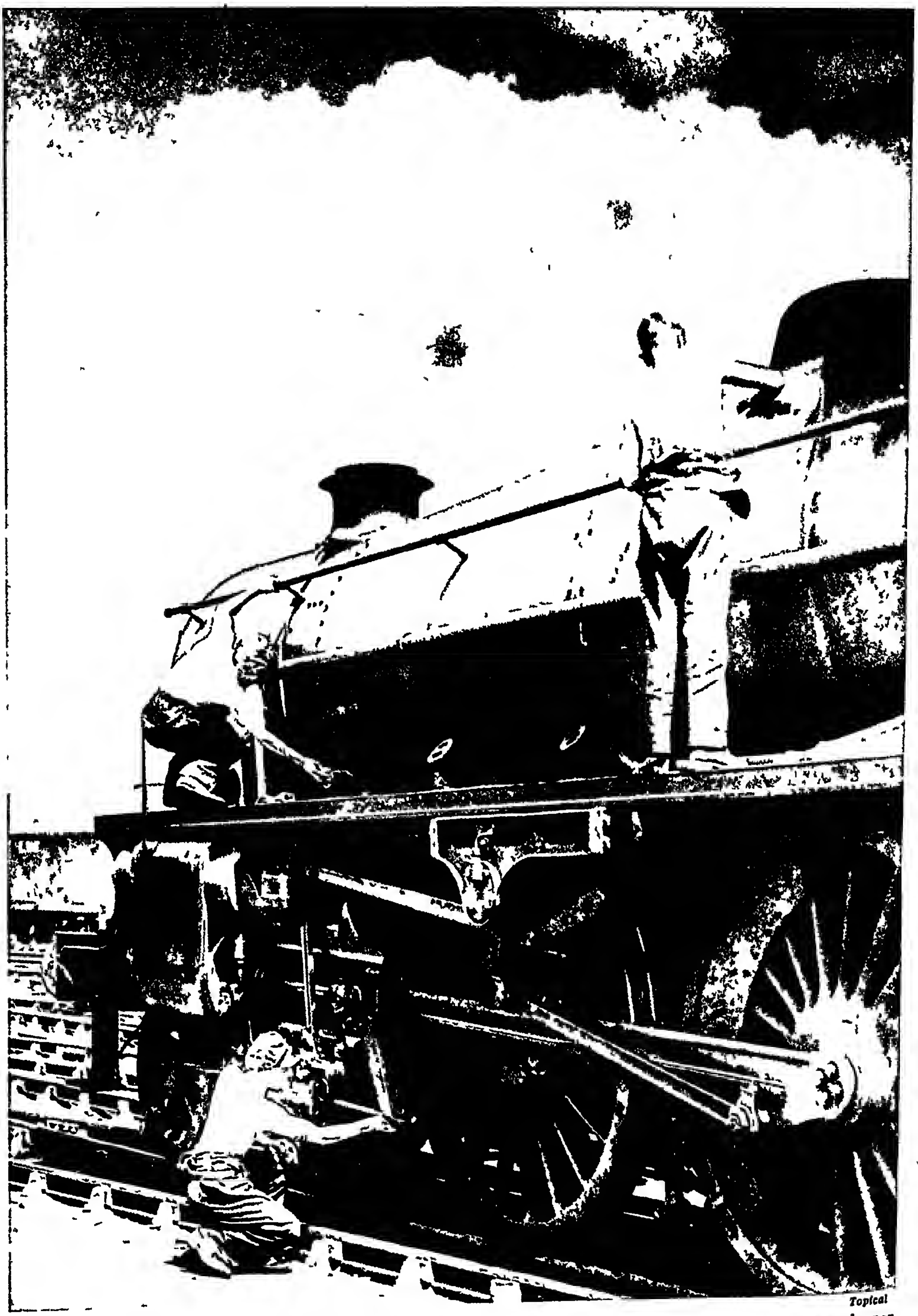
AMERICAN RAILWAY MAMMOTH THAT LIVES ON OIL



J R Hind

This photograph shows the front of the latest type of American streamlined locomotive suggesting in a remarkable degree its speed and power The motive power is a 2,400 h p Diesel motor—an oil engine burning crude petroleum This engine draws a train known as the "City of San Francisco," which makes five round trips a month between Chicago and San Francisco The train consists of eleven cars, including sleeping and dining cars, and provides all the comforts of a hotel for the passengers

FIRST STEP IN THE ENGINE-DRIVER'S CAREER



Topical

When a boy wants to become an engine-driver he first goes to the sheds of some big railway centre as a cleaner The cleaner's work is to clean and wash all the paintwork and polish the steel and brass before the engine starts out on its day's work In dealing with engines of many types cleaners learn all about the working parts before they are promoted to the foot-plate as firemen These lads are at work—during a heat wave !—at the London sheds of the London Midland and Scottish Railway

Lodge, Sir Oliver Joseph (born 1851) When Lord Kelvin was invited to join the board of directors of the newly-formed Marconi Wireless & Telegraph Co he stipulated that Oliver Lodge should also be asked, because he recognized, as has every notable scientist since, that the name of Lodge must for ever be associated with those of Maxwell and Hertz in the brilliant researches and mathematical deductions which made wireless telegraphy possible

Born at Penkhull, Staffordshire, June 12, 1851, Oliver Lodge was, at twenty-four, a lecturer at Bedford College, London, and at thirty professor of physics at Liverpool University Later, he was appointed first principal of Birmingham University, and at various times was President of the British Association, of the Physical Society of London, and of the Society for Psychical Research He was knighted in 1902 and elected F R S The Royal Society presented him with the Albert Gold Medal for his pioneer work in the promotion of wireless telegraphy

It is for his researches into the nature of the ether and his discoveries in wireless communication—and particularly his original tuning method—that Lodge is best known to the public, but only his compeers in science are able to estimate the great value of all his labours in physics, especially in electro-magnetism It is not generally known that he discovered, almost simultaneously with Hertz, the evidence of electric waves, or that his experiments illustrating the vibrations excited when a Leyden jar is discharged were the first practical demonstrations of electric waves

Retiring from the principalship of Birmingham University in 1919, Sir Oliver devoted himself to the study of psychical problems, and eventually became a firm believer in the possibility of real communication with the dead His son Raymond had been killed in the World War, and, in his memory, he wrote "Raymond, or Life and Death" (1916), in which he expounds his views on spiritualism Later he amplified these in "Why I Believe in Personal Immortality," 1928, "The Reality of a Spiritual World," 1930, "Beyond Physics," 1930, and "My Philosophy," 1933

Among his scientific publications, which show the diversity and range of his labours, are "Elementary Mathematics," "Signalling without Wires," "Electrons," "Mathematics for Parents and Teachers," "Ether and Reality," "Relativity," "Man and the Universe," "Modern Views on Electricity," "Life and Matter," and "Science and Human Progress"

Log, Ship's The speed of a vessel is reckoned by a device called a ship's log The older type of log consists of a long line marked into equal sections with knots of coloured cloth To the free end is fastened the log-chip, a small flat board shaped like the sector of a circle and loaded with lead along the rounded edge

When this is hurled (or "heaved") far out over the stern,—it should be thrown to windward—the lead balances it so that it floats point upwards and remains practically stationary As the ship ploughs on, the log-line is allowed to unwind itself freely from its reel At the end of a fixed time the log-chip is hauled in again The number of knots on that part of the log-line which has passed overboard is counted, and in this way the speed at which the ship is running is figured out with fair accuracy

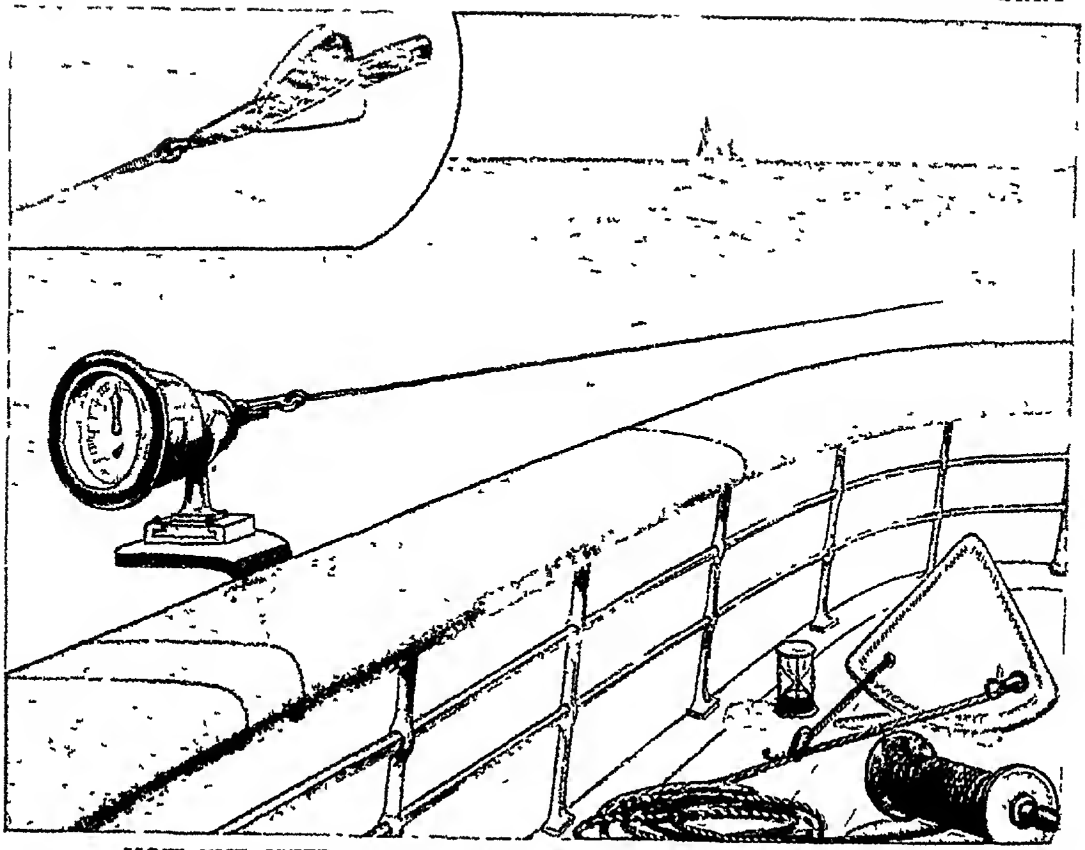
SIR OLIVER LODGE *E O Hoppé*

Here you see the famous scientist, Sir Oliver Lodge, at work in his laboratory At one time he had intended taking up a business career, but the attraction of science was the stronger Some of his lesser-known investigations were on lightning and the electrical dispersal of fog

Commonly the knots are 47 33 feet apart, and the log is allowed to run for 28 seconds With this arrangement the number of knots unwound indicates the number of nautical miles per hour the ship is travelling This explains why the speed per hour of a ship is always spoken of as so many "knots"

Most modern steamers use the patent or "taffrail" log In this, a "fly" or rotator in the form of a propeller takes the place of the log-chip As the fly is towed through the water it rotates, thus twisting the line and operating a system of gears which indicates the ship's speed on a register or dial on deck, just as a speedometer tells the speed of a motor-car

The term "ship's log" or "log book" is also applied to the journals kept by ship commanders to record the course and speed of the vessel, and all other important details of voyages Such



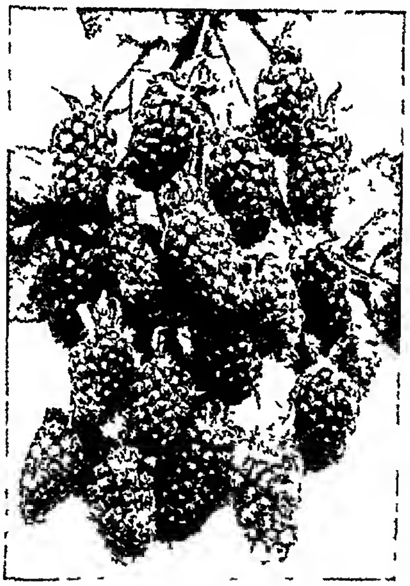
HOW THE SPEED OF SHIPS AT SEA IS MEASURED WITH THE LOG

Lying on the deck is the old-style ship's log, consisting of a measured line attached to a wooden "drag" called a "log-chip" The latter is weighted at the bottom so that it will remain point up in the water and offer enough resistance to drag the line steadily overboard A sand-glass, usually one which will run out in 28 seconds, is used for timing The log-chip is rigged so that, when the log is run, a sudden jerk on the line will detach one side of the "harness" and permit the chip to be pulled back edgeways through the water The "patent" or "taffrail" log is shown attached to the rail At the end of the cable is a small propeller-shaped rotator (top left) The drag through the water sets this whirling, and this in turn whirls the cable, and so operates the gears inside the nautical "speedometer," the hand of which indicates the speed of the ship

records are required by law, and so important is the "log" as a legal record in case of deaths at sea, crimes, shipwrecks, collisions, suits over damaged or lost cargo, and marine insurance cases, that a ship captain will save his log book at any cost

Written in dry and official language, these records often conceal in a brief sentence a whole stirring story of romance or tragedy on the high seas "Seaman John Smith, overboard, rough seas, couldn't lower boats, Seaman Jones swims to rescue with life-line"—such an entry may conceal a piece of unrivalled heroism The details of the sinking of the Lusitania by a German submarine—a deed which stirred the whole world and had a profound effect on the course of the whole World War—were recorded in a few brief sentences in the submarine's log. Yet upon that brief record rested the final conclusive proof of the guilt of Germany's sea-lords for that tragedy

Similar log books must also be carried by every aircraft This, the journey log book, is supplemented by an aircraft log book and engine log book for every machine flying for hire or reward



LOGANBERRY SPRAY

A cross between the blackberry and the raspberry, this fruit, named after an American judge, combines many of the best features of both parents Here is a particularly luscious bunch of fruit

Loganberry. This fruit, which actually is grown comparatively little in England is a cross between raspberry and blackberry It is grown usually against a wall or on trellis work, since it has the climbing or rather, sprawling habit of the blackberry The fruit is purplish-

red, larger than either of its parents, and soft When ripe it is pleasant to eat, with a rather piquant flavour, but usually loganberries are imported tinned, from abroad, principally from America The name comes from the American, Judge Logan, who first produced the fruit

Logarithms. If you want to use the simplest and surest method of multiplying or dividing the most complicated figures (whole numbers or decimals of any length), then you must learn logarithms, rightly described as one of the most valuable inventions ever made in practical mathematics They make the hardest sums as easy as possible With logarithms you multiply by adding, and divide by subtracting, and the numbers you add or subtract in order to do complicated multiplication and division sums you will find all set out for you in the logarithmic tables found in most mathematical text-books Thus the chances of getting your sums wrong are reduced to a minimum, and it is well known that even great mathematicians can make mistakes when multiplying or dividing long numbers

Logarithms were invented by the Scottish mathematician, John Napier (1550–1617), 8th laird of Merchiston, who in 1614 published a treatise in Latin of only 97 pages called "Mirifici Logarithmorum Canonis Descriptio," which ranks, with Newton's "Principia," among the greatest works in the history of British science He himself coined the word logarithm from two Greek words meaning "ratio" and "number"

What 'Logs' Are & How they Work

The idea is based on another one which we most commonly meet in algebra You probably know that to multiply a^2 by a^3 we merely add together the *indices*, or *powers*, as the small figures are called (the answer being a^5), while to divide a^6 by a^4 we subtract (the answer being a^2) Now, suppose that a represents 10 Then we can state the sum 100×1000 as $10^2 \times 10^3 = 10^5 = 100{,}000$, and the division sum $1{,}000{,}000 - 10{,}000$ as $10^6 - 10^4 = 10^2 = 100$

In logarithms every number is reduced to a power of ten, which is called the base, thus, for instance, 739 can be expressed as $10^{2\ 8686}$ and 547 as $10^{2\ 7380}$ Or, to say it in the correct way, the logarithm of 739 to base 10 is 2 8686, the logarithm of 547 to base 10 is 2 7380 Therefore, if we want to multiply these numbers we can state the sum 739×547 as $10^{2\ 8686} \times 10^{2\ 7380}$ Adding the indices, or logarithms, the answer is $10^{5\ 6066}$, which represents the number 404,233

But it is obvious that we cannot spend our time in working out what powers of 10 the numbers 739 and 547 are, even if we knew how, or what number is represented by $10^{5\ 6066}$ And, indeed, there is no need for us to do that, for it has already been done for us in the logarithm and anti-logarithm tables found in most mathematical text-books This is how they are used

Keeping the same sum (739×547), we turn to our logarithm tables First, knowing that 739 lies between 100 and 1000, we write down the figure 2 This is the part of the logarithm known as the *characteristic*, which is determined from the number of digits in the number whose logarithm we require The characteristic is always one less than the number of digits, that is, it is 2 for 739, 3 for 7396, 4 for 73981, and so on The next step is to look up 739 for the *mantissa* (or decimal part of our logarithm), and, doing so, we find this fraction to be 8686 Adding the characteristic and mantissa together we get 2 8686 as the logarithm of 739 In like manner we find the logarithm of 547 to be 2 7380

Next, as already explained, we add 2 8686 and 2 7380 and get 5 6066 as the logarithm of the quotient of 739×547 In order to find what number this logarithm represents, we reverse the process and turn to the tables of anti-logarithms As the characteristic of our quotient is 5 we know that the answer must contain six figures, or one more than the characteristic Looking up the mantissa, 6066, we get from our tables the value 40423, to this we add 3 in the further column, giving us 404,233, which is the answer we require In other words $739 \times 547 = 404{,}233$

Now, suppose we want the answer to the division sum $6794 - 86$, we proceed exactly in the same manner, writing down for 6794 its characteristic 3 and its mantissa 8322 (thus log 6794 = 3 8322), and for 86 its characteristic 1 and its mantissa 9345 (thus log 86 = 1 9345) As it is a division sum, we must subtract to find our answer 3 8322 − 1 9345 = 1 8977 As before, we turn to the table of anti-logarithms to find the numerical value of 1 8977, knowing that it must consist of at least two whole numbers, since its characteristic is 1, we find that 1 8977 is the logarithm of 79, which is our answer

Finding 'Powers' and 'Roots'

It is often troublesome to find by arithmetical means the square, cube, or higher power of even comparatively small numbers, but never so by logarithms Suppose we want to find the cube of, say, 17, all we have to do is to look up our tables and find log 17 = 1 2304, multiply this by 3 to get 3 6912, and so get the logarithm of the required cube Turning to the table of anti-logarithms we find that 3 6912 is the logarithm of 4913, which is our answer Thus, instead of doing the laborious sum ($17 \times 17 \times 17$), we merely write down $\log (17)^3 = 3 \log 17$, and consult the tables

Similarly, if asked to find the cube root of 2197, we merely look up its logarithm 3 3418

and divide it by 3, giving us 1 1139 Looking up 1 1139 in the anti-logarithms we get the value 1300, and, knowing there must be two whole numbers in the answer, we get 13 as the cube root of 2197

From these simple examples it will be seen that the principal qualities of logarithms are represented by the equations

$\text{Log}(xy) = \log x + \log y$, $\text{Log}(x/y) = \log x - \log y$,

$\text{Log}\ x^y = y \log x$, $\text{Log}(\sqrt[y]{x}) = \frac{1}{y} \log x$,

where x and y are any quantities, and the common base is 10 Of course, these equations may be expanded indefinitely, as, for example, $\log (wxyz) = \log w + \log x + \log y + \log z$

This simple method of multiplication and division, or of obtaining powers or roots, which takes only a few seconds—not nearly as long as you require to read this explanation—is not confined to whole numbers only, but is also applied to decimals The only rule to remember is that the characteristic in the case of decimals is negative, while the mantissa is positive, since the rule holds good that the characteristic is one less than the whole numbers of the expression Thus while log 20 = 1 3010, and log 2 = 0 3010, log 0 20 = $\bar{1}$ *3010*, the mantissa being the same in either case In logarithms the minus sign is placed *above* the characteristic

LOHENGRIN AND ELSA

This picture shows the "Knight of the Swan" with the duchess Elsa whose champion (and later, husband) he was But she broke her vow not to ask him whence he came, and he was carried away again by the mysterious swan-boat

From a painting by Klimsch

Lohengrin. (Pron lō′-en-grin) This "Knight of the Swan" is the hero of a beautiful medieval German legend According to the story, when Elsa, a fair young duchess of Brabant, was in distress and waited despairingly for someone to come to her aid, there appeared a knight in a boat drawn by a silver swan This was Lohengrin, the son of Parsifal (Perceval), and King Arthur sent him from the castle of the Holy Grail to fight as her champion Having won her cause, Lohengrin married Elsa, but he made her promise that she would never ask his name or whence he had come They lived happily until Elsa, yielding to her doubts, asked the fatal question, thereupon Lohengrin was forced to bid her farewell The swan-boat reappeared on the river and bore him away, never to return Wagner made this legend the subject of one of his operas

Loire, River, (Pron lwahr) The longest river in France, the Loire is also the most interesting, for it rises in the south-eastern part of the country, only 85 miles north of the Mediterranean, flows northward for half its course, then sweeps with a great curve toward the south-west, where it passes through a famous country of old Roman ruins and historic medieval castles, discharging its waters at last into the northern part of the Bay of Biscay Its whole course covers about 645 miles

Rising in a spur of the Cévennes Mountains 4,500 feet above sea-level, its headwaters are fed by melting snows from bristling mountain peaks, as it dashes through narrow gorges in a roaring torrent, carrying with it the debris of old volcanic eruptions From this stormy region it emerges upon gentle green fields where white cattle graze Somewhat farther on, where the country is again mountainous, the river flows through a beautiful valley planted with many vineyards and orchards, with here and there a strip of forest or a village with quaint old houses of stone or brick

At the northernmost point reached by the river, 75 miles south-west of Paris, is Orleans, an old city of many historic memories, delivered from the English in the 15th century by Joan of Arc Below Orleans the Loire enters the old province of Touraine, a country of old Roman ruins and frowning feudal towers, whose halls once echoed to the mailed tread of French chivalry About 75 miles south-west of Orleans rise the towers of Tours while 35 miles from the river's mouth is Nantes, where Henry IV of France signed the famous edict giving religious liberty to the Huguenots (1598) At this point the Loire widens into an estuary with many islands, over

portions of which Nantes, now an important manufacturing city, has spread The port of St Nazaire, accessible to the largest ocean-going vessels, lies where the river mingles its waters with those of the Bay of Biscay

The Loire is navigable only in a very limited sense In many places it is choked with rocks and gravel carried down from the mountains, or with sand and clay from the Paris basin, rendering its channel uncertain In the wet season its many tributaries so increase the volume that it floods wide stretches of land along its banks, while in the heat of summer it shrinks to a thread of sand-bars and shallows Many canals, however, have been built as an aid to navigation, notably those connecting it with the Seine, the Saône, and (at Nantes) with the harbour of Brest

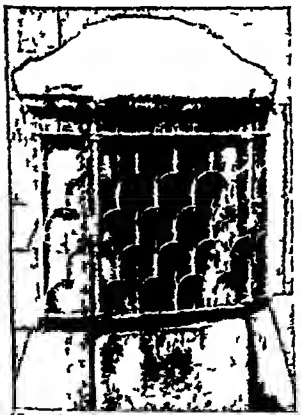
Lombards. The most productive region of Italy, the great fertile valley of the Po, is still called by the name Lombardy, from the barbarian Lombard hordes who overran it in the 6th century These people, the last of the Germanic invaders of Italy, pressed down from the north (568 A D) within 15 years of the time when the emperor Justinian had expelled the East Goths They soon gained the mastery of most of the peninsula, though Rome, Ravenna, and a few other fortified cities successfully resisted their assaults They failed, however, to establish a strong central government Many small dukedoms grew up, thus splitting Italy into numerous small divisions whose jealousies and rivalries helped to lay the foundations for the disunion which lasted until the unification of Italy in 1870 The Lombard kingdom in the valley of the Po lasted a little more than two centuries , it was finally overthrown by Charlemagne (773), who invaded Italy at the request of the Pope, dethroned the king, and was himself crowned with the "iron crown" of Lombardy—so called because beneath the gold was a circlet of iron, said to be made from one of the nails with which Christ was crucified After the break-up of Charlemagne's empire the Lombards gradually merged with the other peoples of Italy

The energetic race which grew up from this fusion of Latin and Teuton became conspicuous from the 13th to the 16th centuries for the success of its members as merchants and money-lenders They found their way to London and other European cities in such numbers that north of the Alps all Italians came to be known as "Lombards," and finally the name "Lombard" became synonymous with "moneylender" One of the streets in the City of London is still called "Lombard Street" after them

The METROPOLIS *of the* WORLD

Other cities may lay claim to be the most beautiful, the most gay, or the most modern in the world, but London remains the greatest of them all, in size and population, industry and commerce

London. If you are visiting London for the first time your impressions as you approach the capital of the Empire may be disappointing



'London Stone' in Cannon Street, a supposed Roman milestone

If you arrive by railway from the north, south, east, or west, you may see only the backs of rather drab houses, you may come through smoky tunnels, through cuttings in which brick walls are all that confront you, or through long rows of sidings where the goods trains that carry the capital's traffic in merchandise are noisily unloaded and marshalled

If you come in by car you will traverse one of the new arterial roads, and you will see examples of ribbon building Along either side of these new concrete roads you will pass factories and small houses, examples of the lack of planning that has marred much of London's outskirts

The factories have been built since the World War, as a result of the movement of industry towards the south of England, for London is now one of the greatest manufacturing centres in the world But London must not be judged by its approaches It is only when you get into the heart of the capital that you can realize its great historic interest, its wonderfully varied life, and its indefinable charm

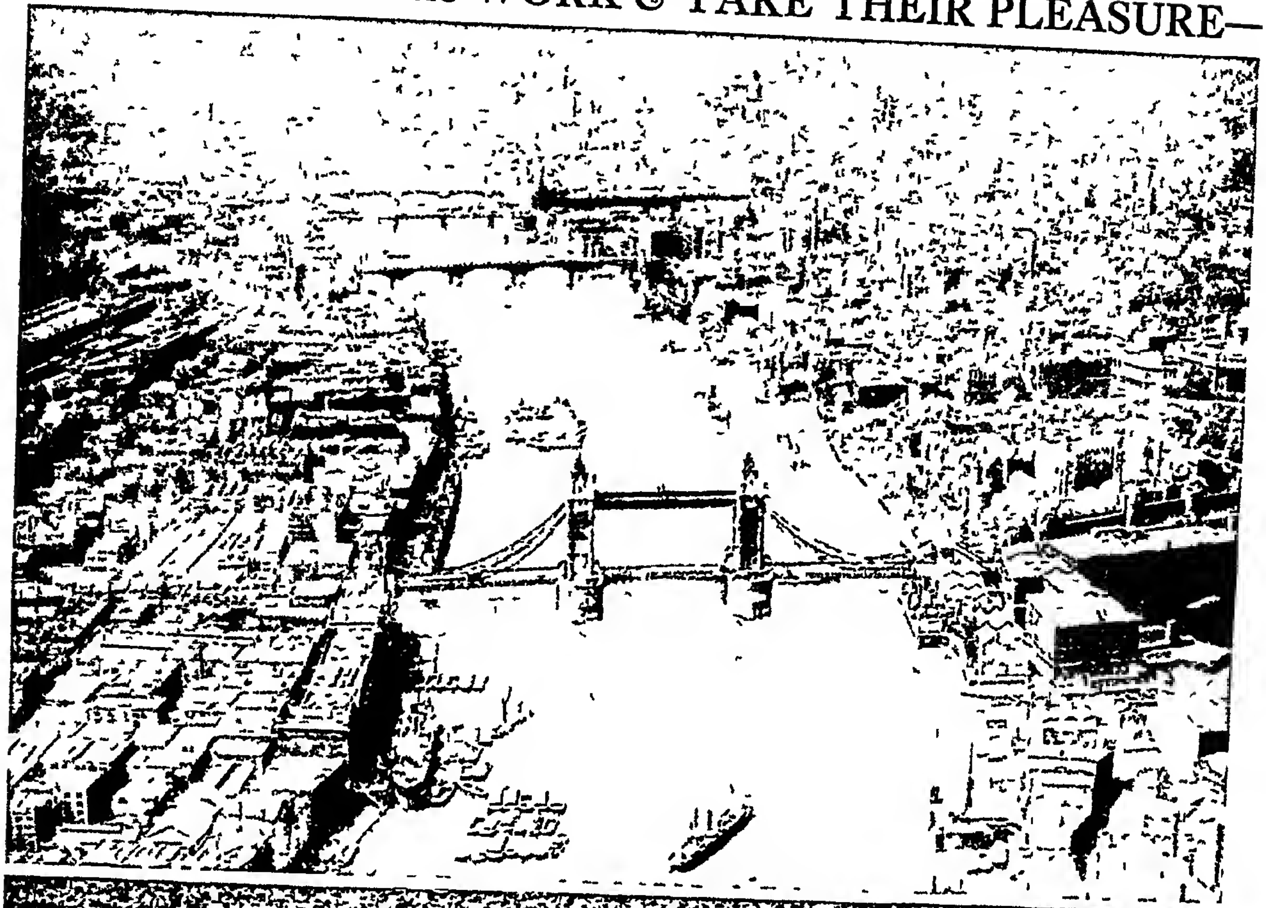
Where Lies London's Heart

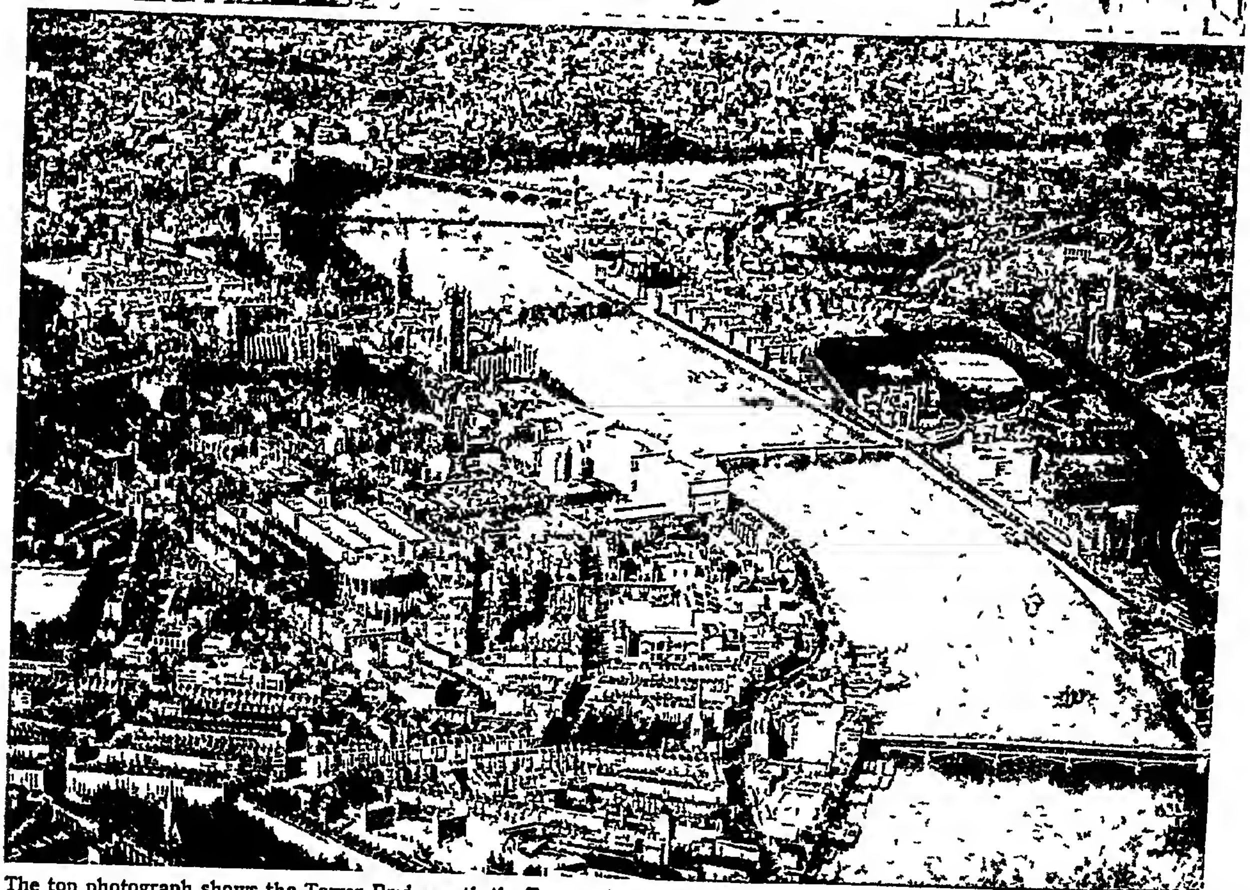
All that is of interest in London lies within a few miles of Charing Cross, which may be considered the heart of London Within the square mile of the City, and within the City of Westminster and the Borough of Southwark most of the great events in London's history have been enacted, and within that small area stand most of London's historic buildings

If, however, we would begin our survey of London from the oldest part of the City we must start from the Tower of London (*q v*)

Around us, as busy as a disturbed ant-hill, is London, the "city of Lud," an ancient king of the Britons who ruled his people in their flimsy huts on the marshy shores of the Thames, in

HERE LONDONERS WORK & TAKE THEIR PLEASURE—

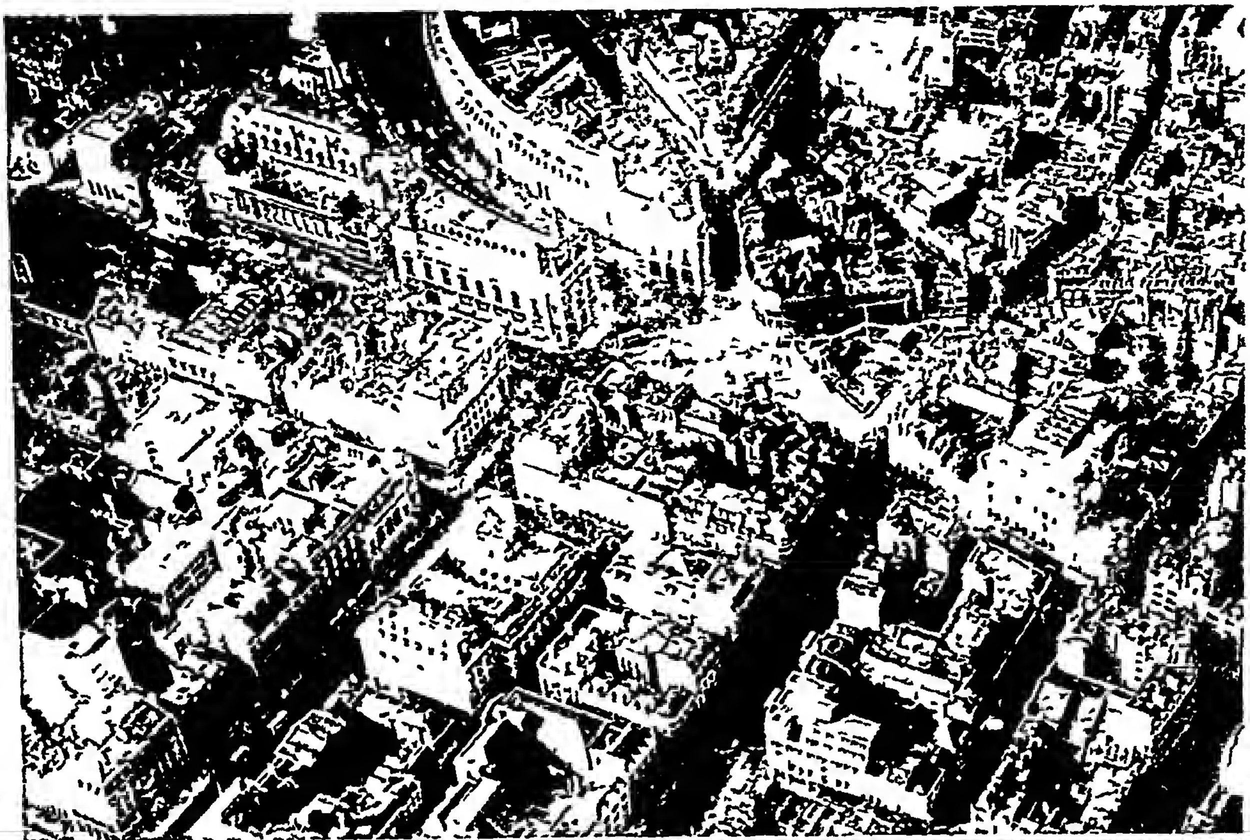


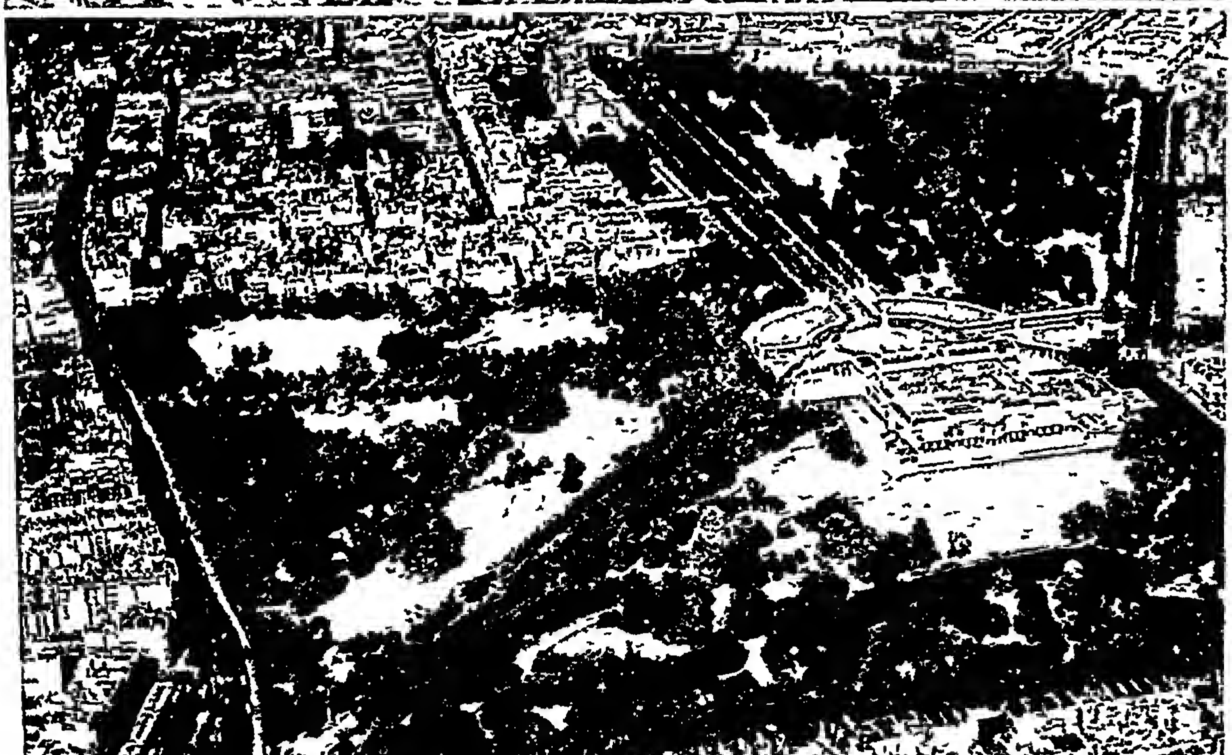


The top photograph shows the Tower Bridge with the Tower of London to the right, then, looking upstream, London Bridge, Cannon Street Railway Bridge, Southwark Bridge and Blackfriars Bridge St Paul's Cathedral is seen to the right, between the last two The lower photograph shows, looking downstream, Vauxhall Bridge, Lambeth Bridge, Westminster Bridge, Charing Cross Railway Bridge, Waterloo Bridge and Blackfriars Bridge The Houses of Parliament are visible, Lambeth Palace is to the right of Lambeth Bridge, and beyond it on the river bank are St Thomas's Hospital and the County Hall

Top photo Aero Pictorial bottom photo Fox

—'LONDON RIVER' AND 'WEST END' FROM THE AIR





Fox Photos

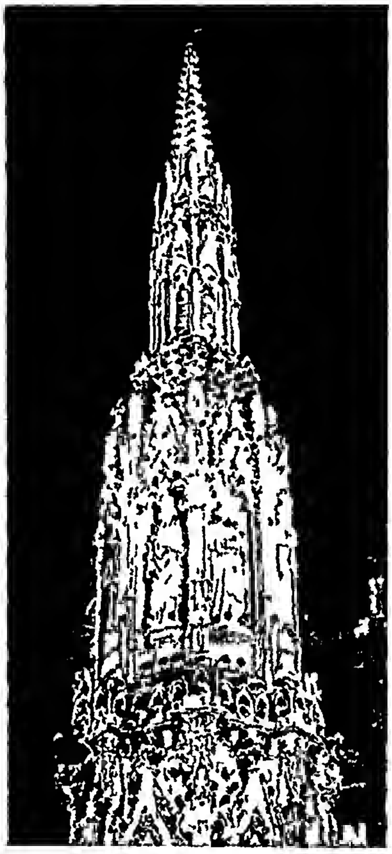
The line of curved buildings seen in the upper photograph is Regent Street, leading into Piccadilly Circus in the centre of which is the Shaftesbury Memorial with the statue of Eros Left from Piccadilly Circus runs Piccadilly, and at right angles to that is the continuation southward of Regent Street The lower photograph shows the Green Park on the left, and St James s Park on the right seen from above Hyde Park Corner Middle right is Buckingham Palace, with the royal gardens Beyond is the Mall dividing the two parks Constitution Hill with its Arch (bottom left) is also visible

the days before the Romans conquered the land Here was the first firm ground on which vessels from the sea could land their goods, and here was the lowest point at which the river could be forded or bridged, so roads converged at this point and London grew to the mighty giant of today Romans built the first bridge where we now see the Tower Bridge King Alfred the Great added to the city's fortifications, and William the Conqueror built the Tower

Let us first get the "lie" of the city from the Tower The Thames sprawls like a great, broad S to the west and south, and winds its course 40 miles eastward to the sea When the Tower was built London had about 30,000 people Its growth since then has been enormous, and today the inhabitants of "Greater London" number about 8,655,000 people

What puzzles you at first is the way the streets twist and turn But you will see that these higgledy-piggledy streets that seem to criss-cross every way really run parallel with the S of the river When we are at the Tower we are close to the heart of business London, with the Royal Mint and the Bank of England, the Stock Exchange (*q v*) and Custom House, busy markets like Billingsgate and Smithfield, and innumerable banking houses, brokers' and insurance offices Near by are Tower Hill, grim scene of many an execution, and the magnificent building of the Port of London Authority, away to the east are the docks in which the liners plying to Africa and Australia, India and the East, and the cargo steamers which carry a great part of the world's commerce load and unload, and there, too, are the slums and poverty of London's East End, including the foreign quarters like "Chinatown"

But in the neighbourhood of the Tower you could hardly shoot an arrow without its dropping into a street famous in finance and history Lombard Street, Threadneedle Street, Cornhill, and Leadenhall Street are narrow streets famous for banking and finance, the first being named after the Italian merchants and bankers who settled there in the 14th and 15th centuries In Leadenhall Street and the vicinity are many shipping offices, and in Throgmorton Street is the Stock Exchange



CHARING CROSS
The cross at Charing Cross, a replica of that erected to Edward I's Queen Eleanor, is a favourite roost for London's starlings When this picture was taken every "bed" was occupied for the night!
Fox Photos

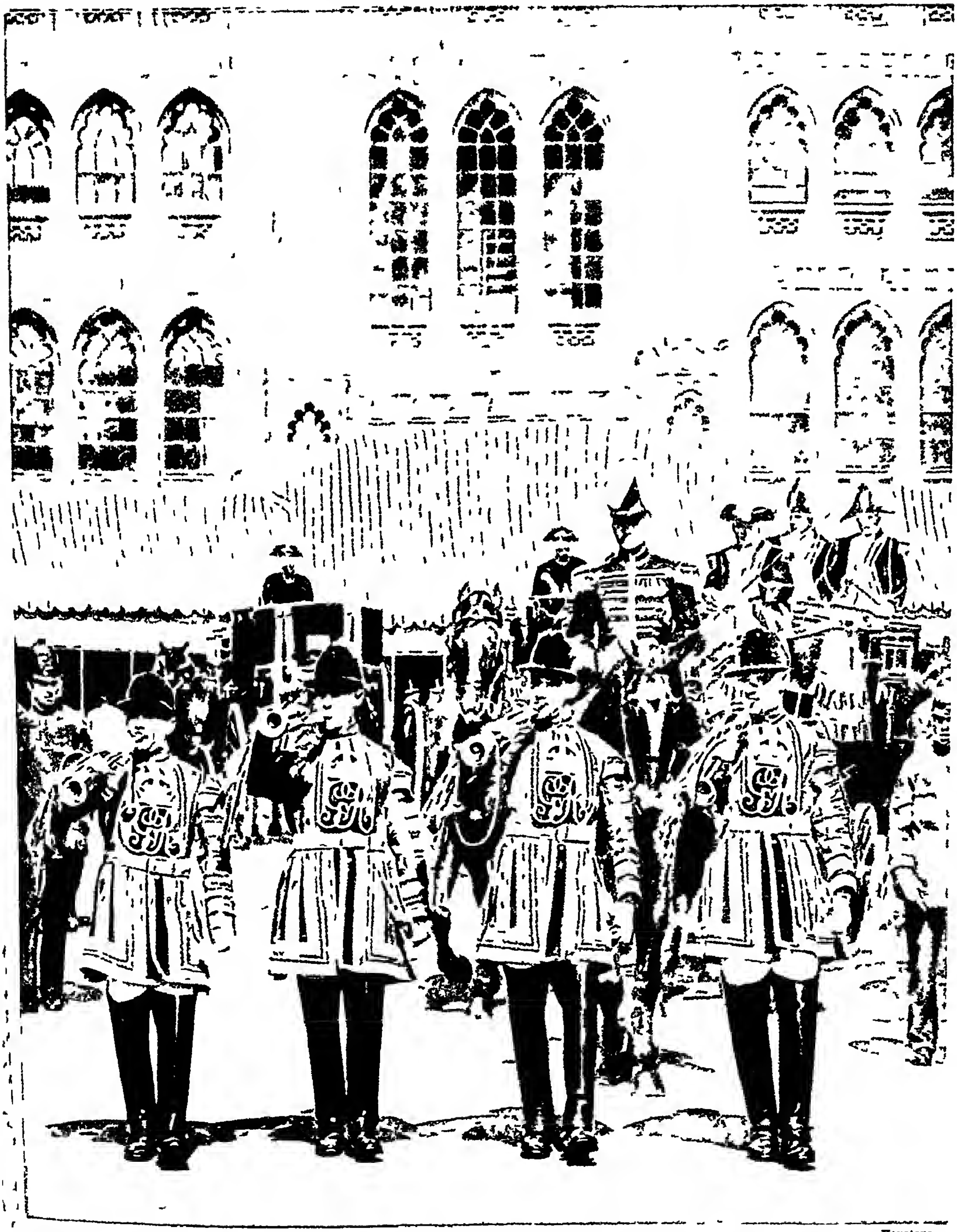
The Bank of England (*q v*)—"the Old Lady of Threadneedle Street," as it is jokingly called—lies just a little north-west of the Tower It covers the most important four acres in the British Empire, and is a centre of world finance Within recent years it has been rebuilt

Everywhere hereabouts are historic memorials Alexander Pope, the poet, was born in a little side-street just off Lombard Street Samuel Pepys, the famous diarist, who spent his days in the Admiralty offices, lived not far from Tower Street The Hudson's Bay Company, which dominated half of North America for two centuries, had offices (and have yet) in London, a few hundred yards from the Bank of England Milton was born in Bread Street, the bakers' quarter, and Sir Thomas More in Milk Street, the site of the old dairies Keats was born near Moorgate, and Thomas Gray in Cornhill

Close to the Bank of England is the Mansion House, the official residence of the Lord Mayor of London, and about a quarter of a mile north of it is the Guildhall, the headquarters of the Corporation of the City of London In its hall and library the City's state functions are held, and many Royalties and other distinguished visitors to London have been entertained there In the Guildhall the Lord Mayor's Banquet, at which the Prime Minister of the day usually makes an important political speech, is held on Lord Mayor's day, November 9, after the Lord Mayor has gone in procession to the Law Courts to be sworn in The Guildhall dates from the beginning of the 15th century The woodwork was destroyed in the Great Fire, but parts of the great hall were untouched and the crypt is intact Half-a-mile west of the Mansion House is St Paul's, the cathedral of the Bishop of London, its chapter has been presided over by a long succession of distinguished Deans, from John Donne, in Stuart times, to Dean Inge

Many books have been written about St Paul's It is as famous as Westminster Abbey, which we shall visit presently in the West End Legend says it is built on the site of a temple to Diana, replaced by the Romans with a Christian church, which in turn was torn down by the pagan Saxons Old St Paul's, famous

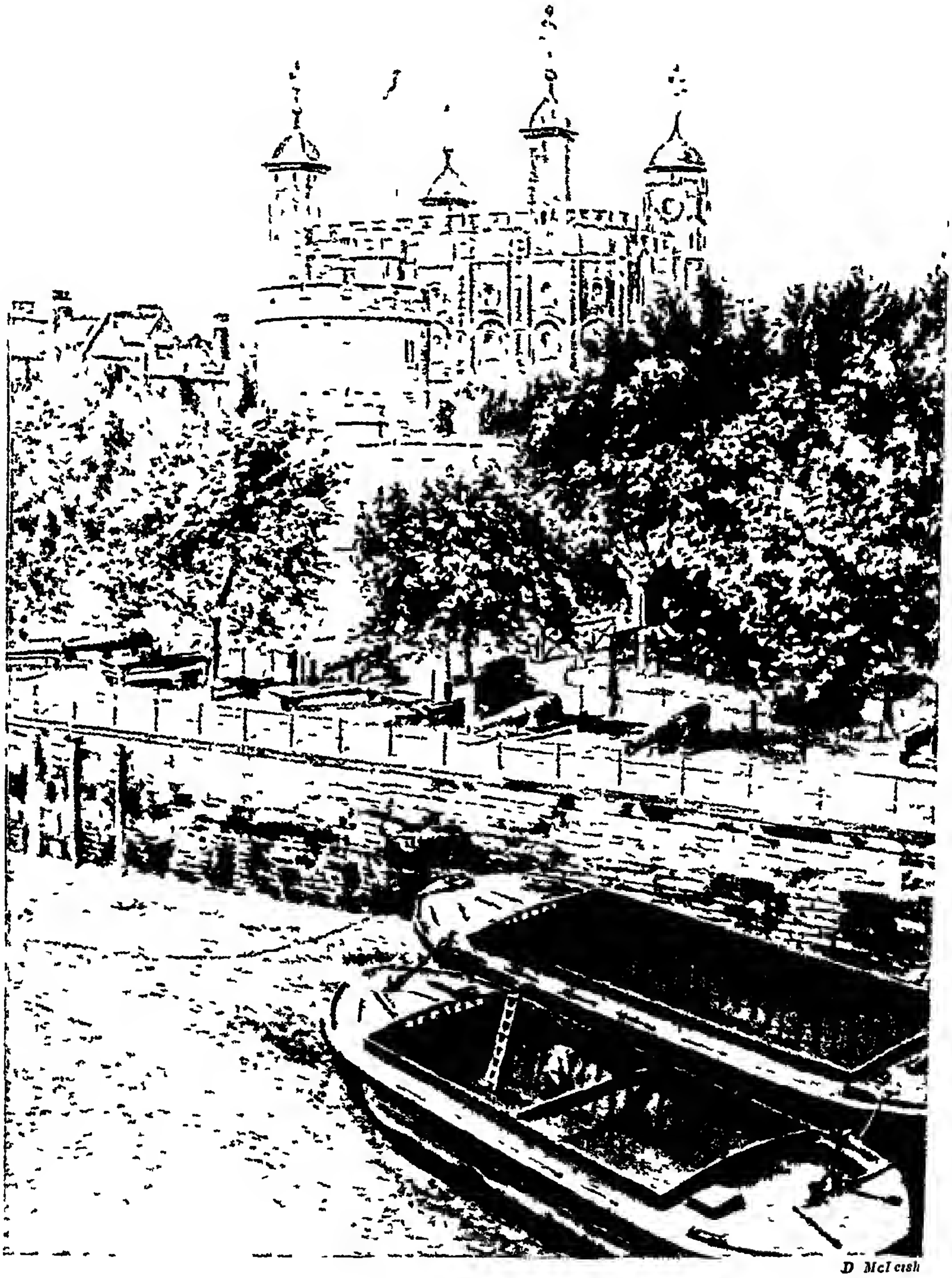
A SHORT TOUR ROUND OLD LONDON



Keystone

Pageantry much of which has come down through many centuries, distinguishes the civic life of the City of London During his year of office the Lord Mayor lives in the Mansion House, but official business is conducted chiefly at the Guildhall The Lord Mayor for the next year is elected at Michaelmas, and this photograph shows the Lord Mayor arriving at the Guildhall for the election of the man who will succeed him in November In the foreground are trumpeters of the Life Guards blowing a fanfare as he arrives Between them and the Lord Mayor s coach is the City Marshal

To face page 2560



D McLeish

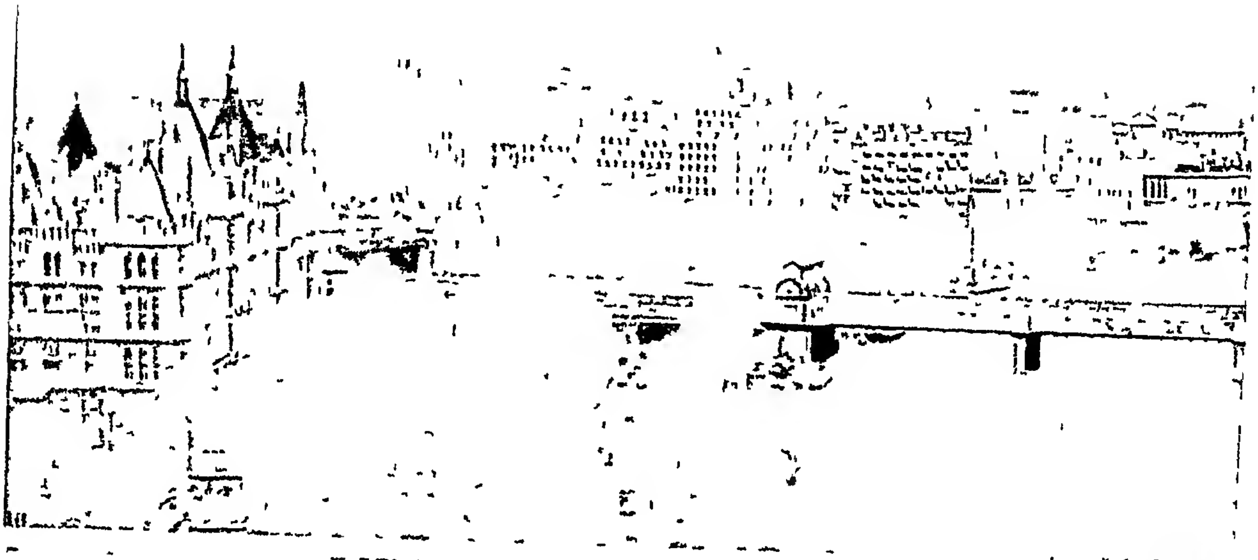
TOWER OF LONDON FROM THE THAMES

Here from the Thames the central block of the Tower of London, known as the White Tower, built by William the Conqueror, is seen It is the oldest part of the famous fortress In front of it is the circular Wakefield Tower in which the Crown Jewels are kept Along the terrace are old guns, relics of Britain's past wars

IN LONDON'S TWO CITIES

That great area which is called London includes within it two cities, the City of London and the City of Westminster. In the City of London St. Paul's Cathedral, seen at the top, is the most famous landmark, while Westminster is chiefly associated with government offices and the Houses of Parliament, seen in the larger picture.

EAST AND WEST ON LONDON'S RIVER



The Tower Bridge, seen in the lower photograph, opens to admit large ships to the Pool of London, which extends as far as London Bridge Below London Bridge the banks of the river are lined on both sides with docks, wharves and warehouses, but above the bridge on the left bank of the Thames is the Embankment stretching from Blackfriars to Chelsea, lined with fine buildings like those seen in the top photograph Crossing the river we see Charing Cross railway bridge , to the left of the bridge is Whitehall Court, a famous residential building, and beyond it is the Shell-Mex building On the extreme right is Somerset House

Photos G P A H Felton

in Reformation days, was built about 1160 The present building was planned by the great architect, Sir Christopher Wren, and is one of more than 50 churches constructed by him after the Great Fire in 1666 had destroyed about four-fifths of the London of that day (*See* St Paul's Cathedral) Wren also built the Monument (near the northern end of London Bridge) to mark the spot where the Fire began

A host of associations cling round the streets in the neighbourhood, such as Paternoster Row, originally inhabited by makers of prayer-beads, but later long associated with the publishing trade, Watling Street, part of the ancient Roman road between Dover and Wroxeter, and Cheapside, the historic thoroughfare in which was the Mermaid Tavern, frequented by Sir Walter Raleigh, Shakespeare, Ben Jonson, and other great poets and wits

Before betaking ourselves to the West End, where we shall find the centre of government, wealth, and fashion, as the East End is of finance, shipping, and poverty, we must glance at the Tower Bridge and London Bridge The former is the last bridge crossing the Thames as it flows towards the sea, and between the two bridges is what is known as the " Pool of London," in which ships of as much as 6,000 tons can berth Such large ships could not pass under an ordinary bridge, so when the Tower Bridge was built between 1886 and 1894 it was necessary that it should open to enable ships to pass The roadway is therefore carried on two bascules, which can be raised and lowered by hydraulic power London Bridge was built by Rennie and opened in 1831 It stands near the site of an old wooden structure which stood for 500 years

We can now make our way westward from St Paul's either along Fleet Street and the Strand or by the Thames Embankment, which stretches in an almost unbroken line from Blackfriars Bridge to Fulham The carriage way is over 60 feet wide and along the roadway there are plane trees with seats beneath

If we wish to see as many famous buildings as possible we shall choose the Fleet Street and Strand route These two streets form the most famous of London's East to West thoroughfares Fleet Street is the heart of newspaper land, and an impressive example of the fine buildings in which great newspapers are housed today is the office of " The Daily Telegraph and Morning Post "

Continuing westward, we can visit some of the most famous landmarks of the capital The first of these is the Temple, lying between the Embankment and Fleet Street, in which are two of the Inns of the lawyers, the Inner Temple and the Middle Temple The hall of the Middle Temple is a magnificent Tudor building in which some of Shakespeare's early plays were probably first performed In the Temple Church are the tombs of some of the Crusaders, for the Temple gets its name from the Crusading Knights Templars, whose stronghold it once was This is the finest of the four round churches remaining in England, and dates from the 12th century Oliver Goldsmith's grave is said to be in its churchyard For

ONE OF WREN'S MASTERPIECES

In designing St Bride's, Fleet Street, Wren bore in mind that the body of the church would be hidden by houses, so he put all his skill into making its spire beautiful This view of the church was seen only for a short time while neighbouring buildings were being rebuilt

Photo A F Kersting

Fox Photo

LOOKING DOWN 'THE STREET OF INK'

This photograph shows Fleet Street, looking eastwards. On the extreme left is the pinnacled tower of St Dunstan's Church. The dominating white building farther down the street is "The Daily Telegraph & Morning Post" office. The great dome of St Paul's Cathedral towers above the city in the distance, while in front of it is the steeple of St Bride's church

the rest, the Temple consists of mellow old brick buildings where barristers have their chambers. Goldsmith, Charles Lamb, and Thackeray all had chambers in the Temple. The other two Inns of Court are Lincoln's Inn and Gray's Inn, both of which have fine old halls.

The first building of note going westward is the Law Courts, a grey stone building with an imposing frontage to the Strand. Proceeding westward, we pass the fine block of buildings which houses the offices of the Government of Australia, and less than half a mile farther on we come to Trafalgar Square, dominated by the Nelson Monument. On the north side of the Square is the National Gallery (*q v*), on the east are the offices of the Union of South Africa, on the west those of the Canadian Government, while on the south side Whitehall opens out towards Westminster. Whitehall and Westminster have been called the heart of the Empire, for in Whitehall are the chief Government offices, the Foreign Office, the Home Office, the Dominions Office, the India Office, and many others. As we go down Whitehall we pass on the right the Horse Guards, whose mounted sentries in their shining steel breastplates attract the admiration of every passer-by, and on the left the last relic of the old Palace of Whitehall, the Banqueting Hall.

Whitehall's grandeur dates back to the great Wolsey, the discarded favourite of Henry VIII, for here was Wolsey's London residence as Archbishop of York. After his fall it became Crown property, and was renamed Whitehall. It became a palace of regal splendour under the Tudors and the Stuarts, but its memories are chiefly tragic. It was here that Henry VIII met Anne Boleyn, and here the selfish monarch died. It was through one of the windows of the Banqueting Hall that Charles I was led out to execution on a scaffold erected in the street. Cromwell lived here; Milton wrote State papers here; Charles II held here the wild orgies of his court and here, too, spent his last hours.

In the centre of Whitehall stand the majestic Cenotaph, erected to the memory of those who died in the World War, and the Earl Haig monument. The official residence of the Prime Minister is in Downing Street, which turns off Whitehall on the right. And near by, down towards the Thames, is that place of mystery and drama—Scotland Yard, the headquarters of the Metropolitan Police.

On the right bank of the Thames we see the magnificent new hall of the London County Council and on the left bank the Houses of Parliament by Westminster Bridge, and at right angles to them is Westminster Abbey. Here is the very heart of the British Empire, here beats the political pulse for a quarter of the people in the known world. The old Parliament building was burned in 1834 when an impatient servant overheated a flue in burning up wooden "tallies" or receipts which had accumulated in the Treasury in the course of six centuries. This afforded the opportunity to erect the present beautiful Gothic building, covering an area of eight acres. In its chambers sit the House of Commons and the House of Lords, amid surroundings of the highest historic significance.

Westminster Hall, which was begun by the Conqueror's son, William Rufus, and remodelled by many of his successors, still stands and serves as a vestibule to the Houses of Parliament. Here were held some of the earliest Parliaments. In this Hall the coronation feasts, carried out

on a most lavish scale, took place until early in the 19th century Here Edward III entertained the captive kings, David of Scotland and John of France, and here Edward II and Richard II were declared deposed In this historic hall Charles I was sentenced by a high court set up by Parliament, and from this hall Cromwell a few years later turned out the "Rump" of that Parliament

The chief English courts were held in Westminster Hall and in buildings on the west side which were erected for the purpose, until the present Law Courts were built Here the bodies of King Edward VII and King George V lay in state while thousands of their subjects filed past to pay their last homage

Just across the street from the Houses of Parliament stands Westminster Abbey, founded by Edward the Confessor and added to by his successors until it became the superb Gothic church that it is today (*See* Westminster Abbey)

We shall not have time to go to St James's Park, not far from Westminster Abbey, or to visit Buckingham Palace and St James's Palace—even if we could gain admission The first impression of these royal palaces would probably be one of disappointment St James's Palace, long disused as a royal residence, is still the official home of the British Monarchy Ambassadors and ministers are accredited to the Court of St James's, and the King still holds his levees there Buckingham Palace is hardly as imposing as many of the private residences of the country But it is neither the luxury nor the beauty of British palaces that makes them dear to the British heart, but what they stand for in our history

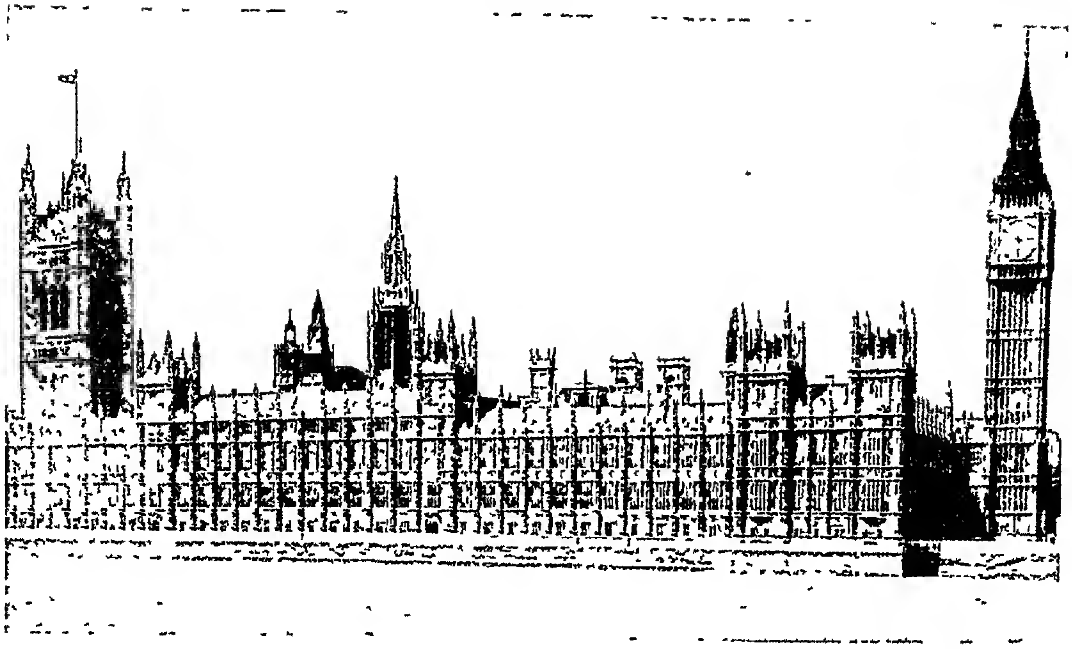
'Spouters' Corner' in the Park

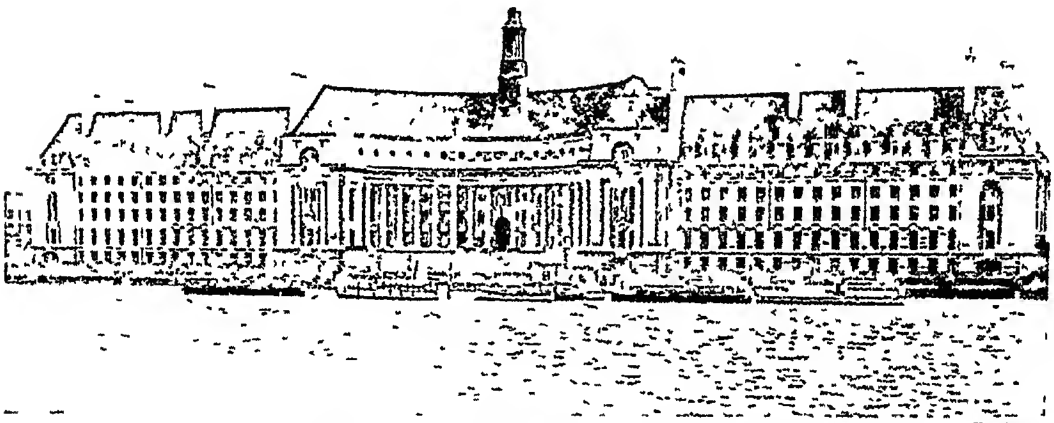
Westward of St James's Park is Hyde Park, a vast expanse of 361 acres (636 acres with Kensington Gardens, which adjoin it), which was once a royal park but is now a people's pleasure ground On Sundays and holidays it is thronged with people Many of them gather in good-natured knots round impromptu orators, who are allowed to speak freely at a spot in the north east corner on almost any subject they desire—religious, political, economic, or what not It is one of the safety-valves of the British constitution In Kensington Gardens stands Kensington Palace, a former Royal residence, in which Queen Victoria was born Here, too, are the Round Pond, a favourite spot for model yachtsmen, and the Peter Pan statue Regent's Park lies a mile to the north, with its Zoo (*See* Zoological Gardens)

Let us now take a bus and ride down Piccadilly from Hyde Park Corner, viewing residences and clubs from the bus top—a favourite method of sight seeing—until we arrive at Piccadilly

TRAFALGAR SQUARE IN THE HEART OF LONDON *Fox Photos*

The most famous of London's many squares is Trafalgar Square, which lies within a hundred yards of Charing Cross, usually considered the centre of London On the south side of it stands the Nelson Column, $168\frac{1}{2}$ feet high, surmounted by a statue of Nelson, 17 feet high with four lions sculptured by Sir Edwin Landseer at the corners of the plinth The building seen just to the right of the column is Canada House, housing the offices of the Canadian Government in London The National Gallery occupies the whole of the north (right) side of the Square





Keystone

LONDON'S SEATS OF IMPERIAL AND LOCAL GOVERNMENT

The top photograph shows the Houses of Parliament from across the river On the extreme right is the Clock Tower with Big Ben, while on the left is the Victoria Tower, through an arch in the base of which the King enters for the opening of Parliament In front of the building is the terrace facing the river The lower photograph shows the County Hall on the opposite bank of the Thames, from here the whole of the County of London, except the square mile of the City, is governed In front of it a row of Thames pleasure-steamers are moored

Circus, from which radiate Regent Street, Shaftesbury Avenue, and Coventry Street, and in the centre of which is the famous fountain surmounted by the figure of Eros, a memorial to the great Lord Shaftesbury, who did so much to arrest the exploitation of child labour Here we are in the heart of the great theatrical district of London, while to the north is the curious Italian quarter called Soho, famous for its many restaurants

The visitor to London will, of course, visit the national picture galleries and museums After the National Gallery and the British Museum (*see* separate articles) the most important collections are the Tate Gallery at Millbank, a branch of the National Gallery, housing modern pictures, the Wallace Collection in Manchester Square, where pictures, furniture, and armour are exhibited, the Victoria and Albert Museum, where there are interesting exhibits of furniture and other objects, the Science Museum, Natural History Museum, and Geological Museum, the four last-named being at South Kensington The London Museum, at Lancaster House, just north of St James's Park, houses an interesting collection of relics of old London and of costumes, including some of the Royal robes The Imperial War Museum, now in Lambeth, is a great storehouse of exhibits connected with the World War

You have only touched here and there the central parts of metropolitan London To the north lie enormous residential areas, such as Hampstead and Camden Town To the east are Greenwich and Woolwich—the one the seat of the Royal Observatory on the central meridian of longitude, the other of the Royal Arsenal and the Royal Military Academy To the south of the historic river are Battersea (with its great power-station), and Lambeth, and to the west Chelsea

On the south side of the river is the borough of Southwark It is a purely industrial district, but you may see the spot where stood the Globe Theatre in which Shakespeare acted

Dates in London's History

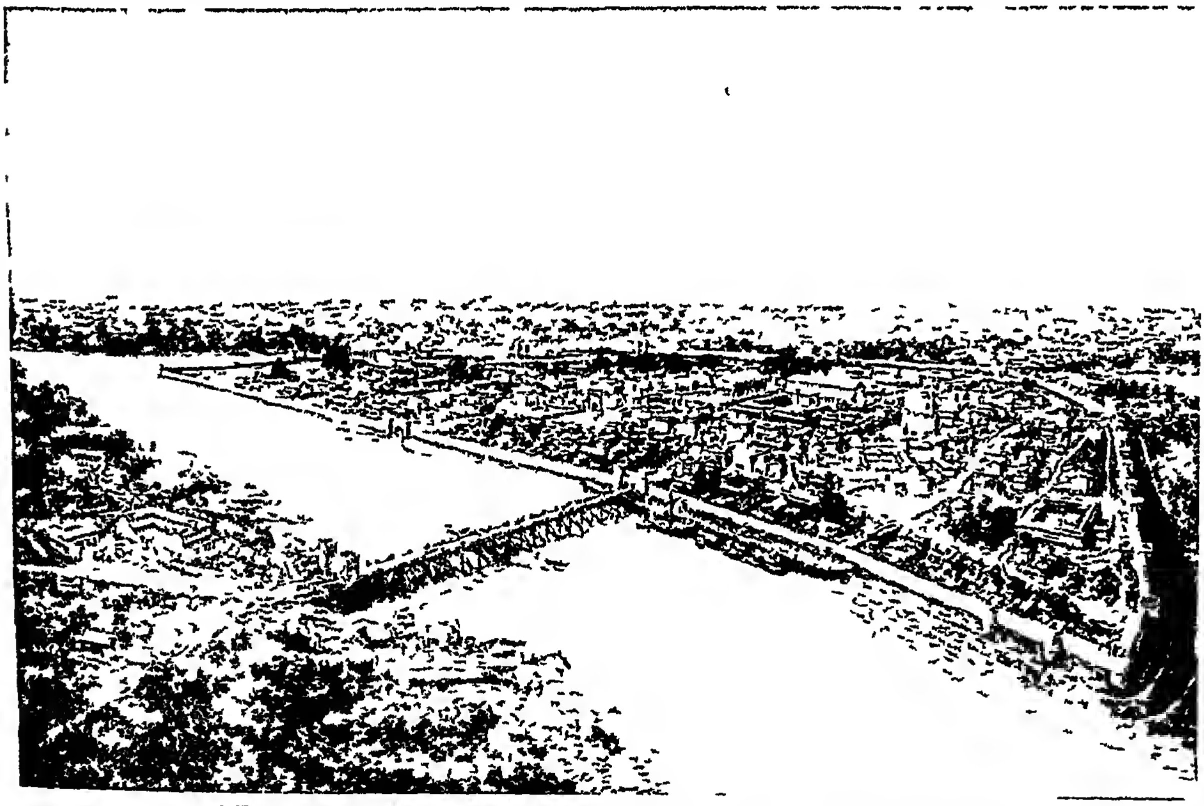
London became a place of importance under the Romans, probably first in A D 43 It was burned by the Britons under Queen Boadicca in A D 61 From 369 till 412 it was the capital of Roman Britain (being known as *Londinium*) Bede calls it a "princely town of trade," when it was the capital of the East Saxon kingdom King Alfred restored the city after it had been burned and the Roman walls destroyed by the Danes London, already rich and prosperous, sided with the House of York in the Wars of the Roses The principles of the Reformation were welcomed and the suppression of monasteries and the confiscation of their property under Henry VIII made him popular, though the same treatment of the guilds lost the Duke of Somerset the favour of the citizens

Under Queen Elizabeth new openings for adventure in America and India gave a great impulse to the city's trade London was a powerful aid to Parliament in its war with Charles I, and the city's "trained bands," made up of Puritan apprentices, fought on many a battlefield The plague, which had several times visited London, in 1665 destroyed one fifth of the population, and the Great Fire of 1666 burnt 396 acres of houses

London was first lighted by lanterns in 1415, by gas in 1807 The streets were first paved in 1533 Omnibuses began to run on regular routes in 1829, the Metropolitan underground was opened in 1863, and the first "tube" in 1890 These now consist of about 700 miles of railway, included with the buses, trams, and "Green Line" coaches in one vast undertaking known as London Transport

London possesses many educational establishments, the chief of which is London University (*q v*) Then there are public schools like Westminster, St Paul's, and the City of London

The resident population of the square-mile "City" (within the Roman walls, the gates of



RECONSTRUCTION OF THE LONDON OF ROMAN TIMES

This reconstruction shows London much as it must have been during the Roman occupation of Britain In the foreground is the timber bridge, a little farther downstream than the present London Bridge On either side of the bridge gate at the London end are wharves From the bridge a street runs to the Forum and Basilica, the site of which is known from modern excavations The walls are shown with the towers that were added to them towards the close of the Roman occupation

From the reconstruction by Dr M Wheeler and A Forestier in the London Museum

which have given their names to streets like Aldgate and Bishopsgate), is less than 11,000 In addition, London comprises 28 metropolitan "boroughs," each administering its own affairs The London County Council takes care of most matters concerning London as a whole It consists of the chairman, 20 aldermen, and 124 councillors The "City" is governed by a Lord Mayor, 25 aldermen, and over 200 common councillors (*See also* Livery Companies)

The administrative county of London and the City together cover 117 square miles and have a population of 4,863,000 What is known as Greater London includes the Metropolitan Police District and the City of London Police District, and covers an area of nearly 699 square miles, with a population of 8,655,000 It is a little difficult to appreciate the fact that the city of London has 48 miles of thoroughfares, including bridges, courts, and alleys Every night of the year these are washed down by an army of men whose weapons are hose, scraper, shovel, and broom Small wonder that London, with all this care, is the cleanest city in the wide world

The skyline of London is changing Old and familiar landmarks disappear Blocks of small buildings make way for huge structures—a typical example being Broadcasting House, headquarters of the B B C, in Portland Place But London is scarcely likely to become a city of skyscrapers, for the all-sufficient reason that the nature of the soil prevents it There is no solid rock on which to build foundations

Londonderry, NORTHERN IRELAND Covering some 816 square miles, with a population of about 142,000, this county, more familiarly known as Derry, is one of the six counties which together constitute Northern Ireland Divided into two unequal parts by the beautiful Lough Foyle, it is bounded on the north by the Atlantic and on the south by Lough Neagh

Pasture and tillage areas are about equal, with flax and oats the main crops Linen manufacture is the chief industry, and a large export trade in livestock to Glasgow and Liverpool is carried on from Londonderry City and Coleraine The latter town is the centre of the famous river Bann salmon fisheries Brewing and distilling and the manufacture of earthenware are important subsidiary industries Given to the citizens of London by King James I, Londonderry, the capital city (population, about 47,000), was founded about 546 by St Columba, who called it Doire, the "place of oaks," from which Derry, the city's original name, is derived It is also known as the "Maiden City" in commemoration of having successfully withstood the siege of 1689

London University. Though this is the largest university in the world, both in number of colleges and in number of students, a very small proportion of Londoners ever realize that theirs is a university town This is probably because, apart from occasional "rags," the students living in London never obtrude themselves on the public—and, indeed, are unrecognizable as students, since they do not wear gowns in the streets, like those of Oxford and Cambridge, and partly because the colleges are scattered so far apart throughout Greater London from Hampstead in the north to New Cross Gate in the south, from Kensington in the west to Mile End Road in the east

London University consists of some forty schools and colleges, including, among the best-known, King's College, Strand, University College, Gower Street, the Imperial College of Science, South Kensington, Bedford College

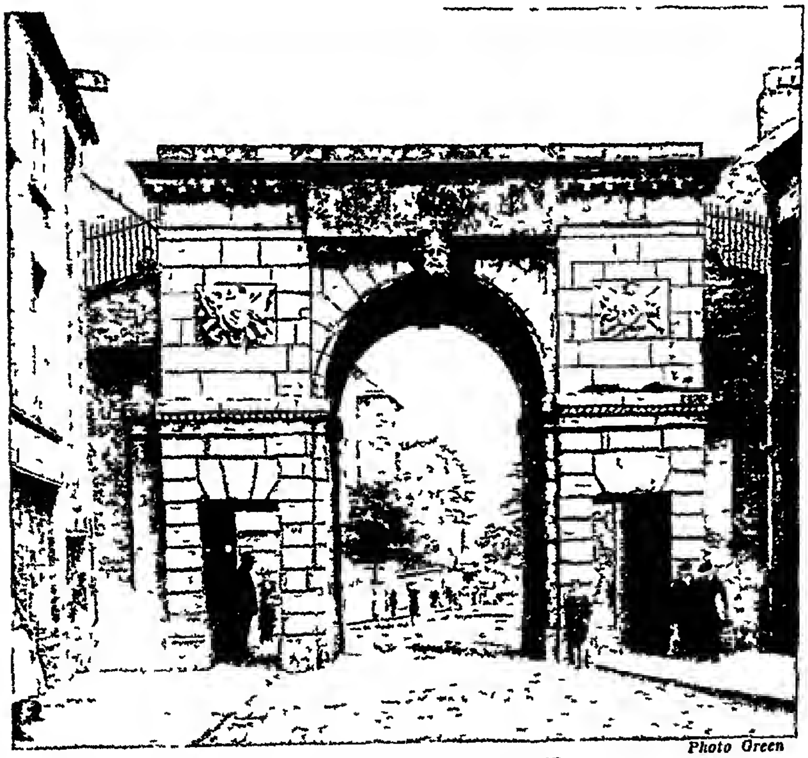


Photo Green

LONDONDERRY'S ARCH

This arch, built in 1789 in memory of William of Orange, is called the Bishop's Arch as it stands near the episcopal palace Through an earlier arch on the same site sorties were made by the besieged during the siege (1689) of Londonderry by James II

(for women), Birkbeck College (for evening classes), Goldsmiths' College, the Slade School of Art, the teaching departments of several great hospitals, and the former London Day Training College for teachers (now called the Institute of Education) But there is no residential qualification for London University students—they may, and do, live anywhere in the world, comparatively few live in London itself, and only a tiny fraction in the hostels attached to the University All may sit for the examinations, but those attending a school or college of the University are registered as "internal" students, and those studying elsewhere, or at home, are called 'external" students The number of internal students in 1936 was 13,600

The University is governed by a Chancellor, Vice Chancellor, Chairman of Convocation, and Principal, all members of what is called the Court, and by a Senate, which comprises these gentlemen and the heads of the schools and colleges The University was founded in 1836, first as an examining university alone, and in 1900 was made a teaching university In 1936 occurred two great events in its history—the celebration of its first centenary, and the beginning of the removal of certain of its departments to the new London University buildings in Bloomsbury, of which the foundation stone had been laid in 1933 by King George V These buildings (*see* illustrations in pages 706, 707, and 709) will house the administrative offices (removed from South Kensington in 1936), the library, the Institute of Education, Schools of Oriental and Slavonic Studies, Birkbeck College, the Courtauld Institute of Art, and the students' Union

London ranks as a "modern" university, offering tuition and examination in practically every branch of knowledge Particulars of its courses and degrees, and of enrolment as internal or external student, may be obtained from the Secretary, London University, Bloomsbury, W C 1

NORTH AMERICA'S GREATEST POET

Probably more of Longfellow's verse is known by heart in the English-speaking countries than any other poet's, for we all learn something of his at school, even if it is only "The Wreck of the Hesperus"

Longfellow, Henry Wadsworth (1807–1882) Have you a favourite poet? If it is Longfellow, then Hiawatha is a friend of yours, and King Olaf, that fine strapping hero, you know all about the village blacksmith, and "Evangeline" with its "forest primeval" makes you feel both sad and happy

Longfellow was himself not unlike a child, big and simple-hearted and friendly He taught young people for many years as professor of modern languages, he had children of his own, and he helped and encouraged many young poets Everybody loved him, from his great contemporaries like Emerson, Hawthorne, and Holmes, to the children he played with every afternoon at the "children's hour"

He did an important service in opening the eyes of his countrymen to the beauties of European legends and literature He knew French and Italian and German, and his verse translations—especially of Dante's "Divine Comedy"—brought many foreign poems within the reach of the American people His own poetry, too, was often founded on some European folk story or legend, as, for instance, most of the "Tales of a Wayside Inn" and "The Sagas of King Olaf" Others, like "Paul Revere's Ride" and "The Courtship of Miles Standish," were actually founded on memorable events in American history

In his famous "Hiawatha,' Longfellow used material found in old Indian legends The Iroquois Indians had stories of a great and wise chief named Hiawatha, who lived shortly before the appearance of the white man in America, and who played an important part in bringing together the tribes of the powerful Iroquois League There were, also, numerous legends among the Indians of the Great Lakes, about another hero known by various names Longfellow became interested in these legends, and decided to embody them in a narrative poem

The hero, according to Longfellow, was "a personage of miraculous birth, who was sent among them (the Indians) to clear their rivers, forests, and fishing grounds, and to teach them the arts of peace He was known among the various tribes by the several names of Michabou, Chiabo, Manabozo, Tarenyawgon, and Hiawatha" Longfellow gave his hero the name Hiawatha as this seemed to him the most musical its cadences may even have suggested the trochaic metre of the poem

Longfellow also wrote shorter poems that are very famous "A Psalm of Life," "Excelsior," "The Children's Hour,' and others His poems soon won recognition abroad, and were translated into European languages He is one of the most popular poets in literature

Longfellow's personal life was rather uneventful He was born at Portland, U S A, and passed his childhood in this beautiful town with its elm-shaded streets and wide view over the bay When he was 18 he graduated in the

same class with Hawthorne, and after three years' travel and study in Europe returned to his alma mater as professor of modern languages He remained here until 1835, when he resigned to accept a similar appointment at Harvard

In the same year came his first great sorrow, the death of his young wife while he was travelling with her in Holland In 1843 he married again, the second wife being the heroine of his prose romance "Hyperion" Eighteen years of idyllic happiness followed, and these were also the greatest creative years of his life A tragic break came when his wife was burned to death It was long before he recovered from the shock, but his last years were made happier by the devotion of his five children

Longfellow's Story of Hiawatha

MANY years ago, by the shores of Lake Superior, which the Indians called Gitche Gumee, "the shining Big-Sea Water," there stood the wigwam of old Nokomis, Daughter of the Moon Here she lived with her grandson Hiawatha, whose beautiful mother had died when he was a baby, and whose father, Mudjekeewis, the West Wind, had gone off and forgotten all about him Nokomis hushed the little one to sleep in his moss-lined cradle, and told him many a fanciful tale about the moon, the fiery comet, or the rainbow which he saw above the dusky pine trees that cast their velvet shadows about the wigwam

Almost as soon as he learned to speak, the sturdy little Indian boy learned also the language of all the birds, "learned their names and all their secrets," and called them 'Hiawatha's chickens" So, too, he learned all about the beasts of the field and forest

> How the beavers built their lodges,
> How the squirrels hid their acorns
> How the reindeer ran so swiftly,
> Why the rabbit was so timid,
> Talked with them whene'er he met them,
> Called them "Hiawatha's brothers"

So Hiawatha grew into a strong, brave, and noble man He was a mighty hunter and had many strange adventures He wore magic mittens of deerskin with which he could smite great rocks asunder, and moccasins which took him a mile at a stride

One of Hiawatha's great battles was with the fierce Pearl-Feather, a wicked magician who lived in a wigwam among stagnant pools guarded by coiling serpents Because of a magic shirt he wore, Pearl-Feather could not be harmed At last Hiawatha, wounded, exhausted, and in despair, had only three arrows left "Aim your arrows at the roots of his hair Hiawatha," sang a woodpecker to him Hiawatha did so, and the mighty magician lay dead at his feet Then, before he took back the furs, wampum, and other enemy trophies to divide among his people, Hiawatha stained the little woodpecker's head with blood in honour of his service That crimson badge the woodpecker proudly wears to this day

In order that he might bring blessing to his people, Hiawatha once went alone into the forest to fast and pray On the fourth day of his fasting, as he lay on his couch exhausted, a

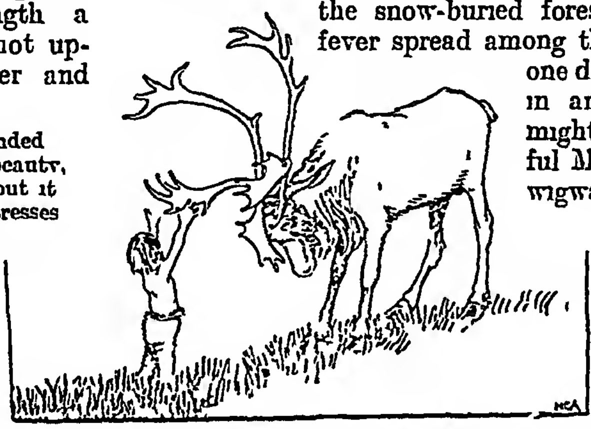
LONGFELLOW AND HIS DAUGHTER

No doubt one reason why Longfellow made such an appeal to young people was because *he loved them so deeply* His poem, "The Children's Hour," draws a delightful picture of his daughters—"Grave Alice and laughing Allegra and Edith with the golden hair" This picture shows Edith reading to her father something that has attracted her

youth dressed in green and yellow garments, with plumes of green falling over his golden hair, came to Hiawatha and bade him wrestle with him Hiawatha arose, and, feeling new life and vigour within him, wrestled with the stranger until he cried, " 'Tis enough " On the morrow, and again on the next day, the youth Mondamin came and wrestled with Hiawatha As he departed after the third conflict he said that he would come once again, and that this time Hiawatha should conquer him

At last, on the fourth day, after a long struggle, Mondamin lay lifeless on the ground, with his hair dishevelled, his plumage torn, and his garments tattered Hiawatha buried him carefully in the soft earth, as Mondamin had bidden him, where the rain might fall upon him and the sun might warm him Day by day he watched beside the grave and tended it carefully, "till at length a small green feather" shot upward, and then another and another

> And before the Summer ended
> Stood the Maize in all its beauty,
> With its shining robes about it
> And its long, soft, golden tresses



The hero makes friends with animals

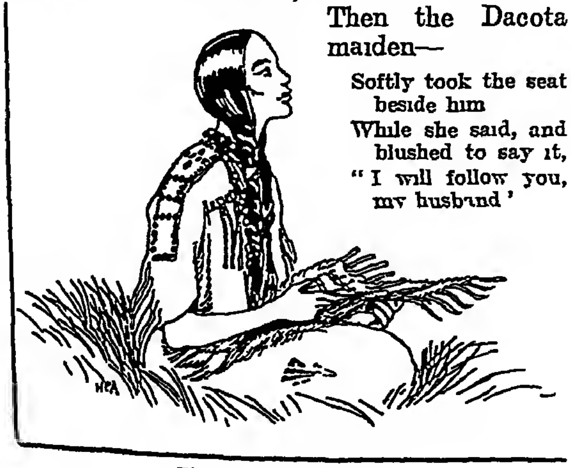
Sketches by Honor C Appleton from The Children's Hiawatha published by George G Harrap & Co Ltd

Thus it was that Hiawatha gave to his people the great gift of maize, or Indian corn

The Indians saw in Hiawatha the prophet and great teacher that Gitche Manity had promised to send them Hiawatha taught them picture-writing, the art of healing, and many other things , and he kept the tribes at peace

Hiawatha fell in love with Minnehaha, or Laughing Water, the beautiful daughter of an old arrow-maker in the land of the Dacotas To woo her he brought her a fine red deer, and, laying it before her feet, told her of his love Then the Dacota maiden—

> Softly took the seat beside him
> While she said, and blushed to say it,
> " I will follow you, my husband '



The lovely Minnehaha

Hiawatha in his canoe.

Hiawatha took his bride back to the land of the peaceful Ojibways, where a great wedding feast awaited them

Hiawatha and his bride were very happy together, but at last there came a cold dreary winter, when the Indians could hunt no food in the snow-buried forests, and an epidemic of fever spread among the starving tribes Then one day Hiawatha strode forth in anguish, praying that he might find food for his beautiful Minnehaha, who lay in the wigwam stricken with fever

While he was gone Minnehaha lifted up her head " Hark ! " she cried, " I hear the Falls of Minnehaha calling, calling to me ! "

" No, my child," said old Nokomis, soothingly, " it is but the night wind in the pines '

" Look ! " exclaimed the girl, " I see my lonely father beckoning me "

" 'Tis but the smoke you see,' answered Nokomis

" Ah," cried Minnehaha, " I see strange glaring eyes—and icy fingers Hiawatha ' Hiawatha ! "

Far away in the forest Hiawatha heard the cry, and, hurrying back, burst into the wigwam But Death had already claimed his beautiful Laughing Water

Spring climbed over the hills with birds and blossoms to bring comfort to Minnehaha's husband And with summer there came a morning when from his wigwam door Hiawatha stood looking over the sparkling waters of Gitche Gumee Suddenly, he lifted up his hands toward the sun and smiled, as though he were dreaming a very beautiful dream

Over the water, with paddles flashing in the sunlight, came a birch canoe filled with strange white men Old Iagoo, the traveller, had already brought word of these creatures, and Hiawatha in a vision had seen the pale-faces, sent by the Great Spirit to bring the Indians a message As

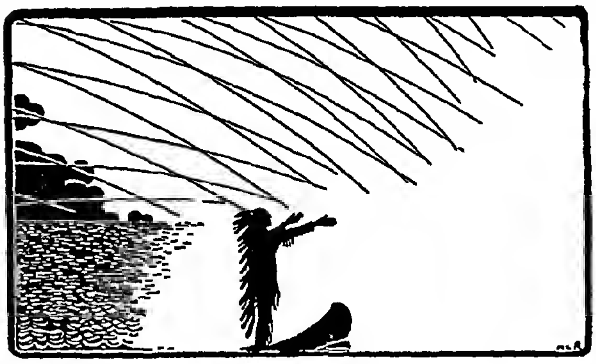
the boat grated upon the shore, Hiawatha stepped forward and welcomed them joyously

"Beautiful is the sun, O strangers," he cried, "when you come so far to see us"

"Peace be with you and your people," answered the white-faced leader, who wore the long black robe of a priest

The Indian leader welcomed them to his dwelling, where the important chiefs and medicine-men of the village gathered to do them honour After food had been served and a peace-pipe smoked in their honour, the priest told his message, the story of Jesus And the Indians thanked him, saying

"We have heard your words of wisdom It is well for us, O brothers, that you come so far to see us"



"Thus departed Hiawatha"

That evening, at dusk, while his guests slumbered in his wigwam, Hiawatha stole softly out of the door

"I am going on a long and distant journey," he told Nokomis and his people "Many winters will vanish ere I again appear, as I am going to the portals of the sunset See that you guard well these white strangers and listen to their words of wisdom The Master has sent them from the land of light and morning"

Then he stepped into his canoe, turned and waved to the sorrowful group on shore, whispered to his boat, "Westward! Westward!" and sailed into the purple and gold of the sunset

"Farewell for ever, O Hiawatha!" cried his people "Farewell!" sighed the forests and the waves and the heron in the fens

Thus departed Hiawatha,
Hiawatha, the Beloved,
In the glory of the sunset,
In the purple mists of evening,
To the Islands of the Blessed,
To the Land of the Hereafter

Longford, Co of Eire This, one of the smallest counties in Ireland, covers only some 420 square miles, with a population of only 37,700 Historically it is one of the richest counties in Eire, possessing a large number of antiquarian relics At Pallas, a small village near the market-town of Ballymahon, and at Edgeworthstown, Maria Edgeworth, the woman novelist whose works had considerable influence on Scott and Jane Austen, spent most of her life, drawing her characters in her three Irish novels from the peasantry around

The soil is marshy and poor in the north, but in the south there are fine pasture lands Oats and potatoes are the main crops Cattle, pigs, and poultry are reared in considerable numbers Agriculture is practically the only occupation, and the whole population may be described as rural Longford, the county town (population, 3,000), is a market centre for grain, butter, and bacon, and here is St Mel's cathedral, one of the most noted Roman Catholic churches in Ireland

Lorrain, Claude (1600–1682) Many of the world's great painters have been men who from boyhood have followed the profession in which they later found fame, but among those who began life in a very different trade is Claude Gelee, better known as Claude Lorrain, for, coming of very humble parents, and being a dull and awkward lad, he was trained as a cook, becoming indeed a very able one It was while still a cook that he went, in an attempt to improve his position, to Rome, and it was there that he first entered the service of an artist, Augustine Tassi His master soon saw the boy's interest and skill, encouraged him, and enlisted his help in the studio, eventually teaching him to paint Once started, Claude made great strides, and soon felt confident enough to return to his own country, devoting himself to his new profession But after two years he was in Rome again, where he remained from 1627 until he died

Fame did not come easily to Claude Lorrain nor, when it came, did it turn his head Himself no figure painter, rather than mar his masterpieces he had the figures put in by experts Although they often give the clue to the titles of Claude's pictures, these figures are small and insignificant, for above all, he was a master of the classical landscape

Unlike many great painters, Claude has never lacked admirers, and his best works are highly prized One great treasure is Claude's "Libri di Verità," an album of several hundred monochrome sketches of his chief works, evidently kept by him for reference, with many notes Like many great French painters of his day, Claude Lorrain was also a fine etcher But it is as the first great landscape master, and as the man who set the standard for his greatest rival, Turner, that he is best remembered (*See* page 1726)

Los Angeles, (Pron los-ang'-gel-éz, or los-an'-jel-ēz), U S A Within a short distance of Los Angeles can be found almost every type of world scenery This advantage, added to the balmy climate and almost perpetual sunshine, has made the city (or, rather, its suburb of Hollywood) the centre of the film industry of the United States and of the world More than

Dorien Leigh

WHERE FILM STARS LIVE IN LOS ANGELES

This photograph shows Hollywood, a suburb which is eight miles distant from the business centre of Los Angeles, though it is now actually part of the city It is famous as the centre of the American film industry It stands amongst most picturesque surroundings, and this photograph shows a road in the Beverly Hills district where are the homes of the film colony

50 film companies have their studios here, and near by is the beautiful residential quarter of Beverly Hills Besides contributing to the city's growth, the industry has given to Los Angeles a unique local colour

But Los Angeles is not only a city of elaborate bungalows, built by the well-to do who have flocked here to enjoy the delightful climate, of enormous tourist hotels, and of moving picture studios It is also the commercial and industrial centre of southern California, and the second greatest seaport of the Pacific coast Lying in the heart of the fruit-growing section, it is the market through which £15,000,000 worth of oranges and lemons are distributed every year It is also the headquarters of the mining industry of a considerable region, and is the centre of an area producing more than 100,000,000 barrels of oil annually

The city was founded by Spanish Franciscans in 1781, and named from a saint's day—*Nuestra Señora Reina de Los Angeles* (Our Lady Queen of the Angels) In 1846 it was taken from Mexico by the U S A The population today is 1,238,000

Lothians, Scottish Counties There are three counties to the south of the Firth of Forth named Lothian—West Lothian (area, 120 sq miles, population, 76,800), sometimes known as Linlithgowshire, Midlothian, formerly Edinburghshire (area, 370 sq miles, population, 526,000), and East Lothian, formerly Haddingtonshire (area, 267 sq miles, population, 47,000)

Several picturesque ranges of hills cover these counties, including the Pentlands and the Moorfoots in Midlothian, rising in several places to over 2,000 ft, and the Lammermuirs along the southern boundary of East Lothian, giving their name to Scott's "Bride of Lammermoor" Besides Edinburgh (*q v*), which includes the seaport of Leith and is the county town of Midlothian, there are few large towns

Linlithgow (population, 3,600) is the county town of West Lothian, with a ruined palace in which Mary Queen of Scots was born From South Queensferry runs the Forth railway bridge, carrying the main line north from Edinburgh Near Musselburgh, in Midlothian, is the battlefield of Pinkie (1547), and, in East Lothian, Prestonpans, scene of a great battle in the 1745 rebellion In East Lothian, Haddington (population, 4,000) is the county town, while on the coast are popular holiday resorts like North Berwick (with a famed golf-course) and Dunbar

Lotus. When we read in Homer's Odyssey of the magical lotus fruit, which caused those who ate it to forget country, friends, and

CHINESE LOTUS

Here are the white flowers and curious round leaves of the oriental lotus, Nelumbium speciosum

THE SACRED INDIAN LOTUS

The lotus, as the figure of the sun and purity, is a sacred symbol to Buddhist India, and occurs everywhere in Indian art This fresco is from a cave temple at Ajanta

From Howell "Ancient Architecture of India" John Murray

home, most of us think of the Egyptian lotus, the sacred water-lily of the Nile (*Nymphaea lotus*), with its white or rose-coloured petals

But to the ancient Greeks the lotus probably meant a prickly shrub (*Zizyphus lotus*) with a sweet mealy fruit, which is still eaten in some Mediterranean districts and used for making wine It is a relative of our English buckthorns The sacred lotus of the Chinese and Hindus is a water-lily much like the Egyptian lotus, and so is the lotus of America

Then there is the lotus tree of the Romans, probably the species now called nettle tree (*Celtis australis*), which is a relative of the elms Finally, botanists restrict the term lotus to a genus of the pea family (*Leguminosae*), containing many species of herbs and low shrubs found in temperate regions of the Old World A common representative is the bird's-foot trefoil of Great Britain (*Lotus corniculatus*)

A lotus design is conspicuous throughout ancient Egyptian, Indian, Chinese, and Japanese art, while many types of Greek ornament have a similar derivation

A Royal NAME *in* FRANCE *for* 1,300 YEARS

This is the story of the long line of French kings, good and bad, named Louis Among them are Louis the Fat, the mighty eater, Saint Louis, Louis the "Sun King", and many others

Louis. KINGS OF FRANCE Throughout thirteen centuries this name figures more prominently—sometimes nobly, at other times ignobly—than any other in the history of France Clovis or Chlodowech (c 466–511), the founder of the kingdom of the Franks, may be considered the first of the numerous French kings to bear the name of Louis In after years the "C" was dropped, and the "v" was written as a "u," thus making our modern name of Louis It is the same as the English Lewis and German Ludwig

But the Louis who is usually reckoned the first in France's royal line was Charlemagne's third son, who succeeded his father as king and emperor, and is called LOUIS THE PIOUS (778–840) The next four, all of them of this Carolingian line, call for no mention here

LOUIS VI (1078–1137), however, was a very different ruler Although he was rightly called "the Fat," he is the first of the new Capetian kings (they first ascended the throne in 987) who in any way deserves to be called "great" This Louis was a great fighter, a great hunter, and a great eater, and at 46 he became too fat to mount a horse

But he remained the embodiment of warlike energy His great task was to reduce to order the petty nobles of the royal domain, who were truly "robber barons" When Louis came to the throne (1108) every lord of a castle robbed at will, and it was not safe for even the king to pass along the road Twenty years of fighting were necessary to remedy this condition, but in the end the king triumphed, and law and order prevailed And to make certain that such evils might not recur, Louis ordered every castle that was captured to be destroyed or given to faithful followers

LOUIS VII (b 1120, reigned 1137–1180) is remembered chiefly for the divorce of his wife, Eleanor, who then married Henry II of England By this proceeding the rich province of Aquitaine in southern France, the dowry of Queen Eleanor, passed from France to England

LOUIS VIII (1187–1226), son of Philip Augustus, reigned for only three years (1223–1226)

LOUIS IX (b 1214, reigned 1226–1270), "Saint Louis," is, perhaps, the most heroic and popular in the whole procession of French monarchs

He was the dutiful, religious son of Louis VIII and his queen, Blanche of Castile His widowed mother often told him that she would much rather see him dead than have him commit a mortal sin She herself was a remarkable woman, who during her son's minority dauntlessly faced the numerous revolts of the nobles

In her son she was fortunate, for he possessed all the good qualities and few of the bad ones of the age in which he lived, indeed, his virtues were so remarkable that after his death the Church declared him a saint His acts of piety, however, such as wearing a hair-cloth shirt, fasting, and waiting on lepers, were usually performed in private To the world he was a fearless knight, thoroughly trained in the art of

war, a conscientious, just, and able king, who was usually good-humoured and kindly but at times became impatient and angry, and a powerful ruler, who greatly strengthened the royal might He improved the government by appointing local officials who were responsible to him for the administration of justice, the collection of taxes, and the government of their districts He encouraged the people to appeal to him if the nobles oppressed them, or if his officials proved unjust He also improved the administration of justice by abolishing trials by combat, and by using in his courts the new lawyers trained in the Roman law, in place of the churchmen who, formerly, alone could read and write

Saint Louis made two Crusades—one to Egypt and the Holy Land (1248–1254), when he was captured and held to ransom by the Saracens, and the other to Tunis, in 1270, where he died of the plague

Louis X (1289–1316) ruled for but two years, 1314–1316

Louis XI (b 1423, reigned 1461–1483) presents a striking contrast to Louis IX In appearance Louis XI was "ugly and unkingly", in character he was unscrupulous, cunning, and underhanded He firmly believed that "he who has success has honour," and he cared nothing for the way in which he attained the success He made promises only to break them, unless he had sworn by one particular saint His one ambition seemed to be to extend the boundaries of France, and although he was too stingy to buy a new hat to replace the shabby old one he wore, he spent large sums in buying back border cities In his conflicts with the nobles, especially with Charles the Bold, Duke of Burgundy, he also acquired much territory, so that by the time of his death most of the land of France had been brought under the direct control of the king The power of the crown in the latter part of his reign was truly absolute over the territory it held Sir Walter Scott, in his novel "Quentin Durward," gives a very fine pen-portrait of Louis XI, as well as an intimate survey of the customs and traditions of the period

Louis XII (b 1462, reigned 1498–1515) is chiefly noted for the Italian wars, begun by Charles VIII, and continued after Louis XII by Francis I

Louis XIII (b 1601, reigned 1610–1643) is chiefly important for the fact that, in spite of all opposition, he for 18 years kept in power his able minister, Richelieu (*See* Richelieu, Cardinal) The first years of the reign were filled with anarchy and disorder When Richelieu came into power, however, all this was changed The Huguenots (*see* Huguenots) were reduced to a mere religious body, and the nobles were humbled National unity and religious peace were secured at home, and France was raised to a great position

Louis XIV (b 1638, reigned 1643–1715) inherited this power, and carried it yet further He was styled the *Grand Monarque*, and his brilliant court at Versailles became the model and the

ST LOUIS CAPTURED BY THE SARACENS

When Jerusalem fell in 1244, St Louis (Louis IX) of France took the lead in forming the Seventh Crusade to recover the Holy City Starting in 1248 he at first successfully invaded Egypt, but at Mansura, in December 1249, he was defeated and captured In this painting by A Cabonel we see him during his captivity, threatened by a menacing crowd of Saracen soldiers

The Pantheon Paris photo Bullo

LOUIS XIV—THE 'SUN KING'—AND HIS FAMILY

The reign of Louis XIV of France was so brilliant that he was known as "le roi soleil" (the sun king), and his court certainly shone with a glory never seen before or since in France In this painting by Nicolas de Largillière the king is seen (seated), with Mme de Maintenon, once his children's governess and later his wife The other figures in the group are Louis XIV's son, the grand dauphin (standing centre), his grandson, the Duke of Burgundy (right), and the latter's child, Louis XIV's great-grandson, the Duke of Anjou, who became Louis XV

Wallace Collection London

despair of other less rich and powerful princes, who accepted his theory of absolute monarchy (*l'Etat c'est moi*, "I am the State") Until 1661 the government was largely in the hands of the wily Italian, Cardinal Mazarin But at his death Louis declared that he would be his own Prime Minister, and from then on he worked faithfully at "his trade of a king"

A passion for fame and the desire to increase French territory in Europe were the leading motives of Louis XIV His first war (1667-68) was an attempt to enforce flimsy claims to part of the Spanish Netherlands (Belgium) His second (1672-78) was directed against "their High Mightinesses," the States-General of Holland, who had baulked him of his prey in the first contest In spite of the great military power of France, the Dutch admiral De Ruyter twice defeated the fleets of the French and their English allies, and Louis XIV failed ingloriously in his attempt to conquer Holland The third war (1689-97) also was directed chiefly against Holland, whose "Stadtholder" had now become King William III of England The German province of the Palatinate was terribly wasted, but the Peace of Ryswick brought only slight gains for France

Louis's last and greatest effort was the War of the Spanish Succession (1701-13), in which the Duke of Marlborough (*see* Marlborough, First Duke of) was the chief leader of the opposing European coalition The right to seat his grandson Philip V on the diminished throne of Spain was small compensation for the thousands of lives and millions of treasure which the French king wilfully wasted in the struggle

Millions more were spent by Louis in building the beautiful palace at Versailles, near Paris, and in maintaining his brilliant court This extravagance of the court meant a heavy burden of taxation for the common people, who were thereby reduced to a misery so great that three quarters of a century later they rose up in rebellion and drove the Bourbons from the throne

Louis XIV had the distinction of ruling longer than any other European king, for it was seventy-three years from the time when he ascended the throne, as a child of less than

five, until his death in 1715 He had outlived his son and his son's son, so that he was succeeded by his great grandson

Louis XV (1710-1774) The luxury of the court of Louis XIV was continued under his weak successor, who also came to the throne at the age of five (1715) The evils from which the country suffered were clearly recognized, but the king when he grew up was too lazy and selfish to try to remedy them

Louis XVI (1754-1793) The storm broke in the reign of the just but irresolute Louis XVI He was awkward and timid, and no man could have appeared less like a king than did Louis XVI, who was 20 years old when he became king (1774)

The French Revolution

Louis realized this himself, and often wished, even before the Revolution, that he were only a common man He was a good horseman, and fond of hunting When he first came to the throne he entrusted the management of the finances of the kingdom to Turgot, one of the greatest of statesmen, and as long as the king followed his minister's advice, the state of the kingdom was improved But he was more often under the influence of the beautiful, but frivolous and extravagant queen, Marie Antoinette, and of self-seeking courtiers These all opposed any financial reforms which would threaten their position and salary their pensions and life of ease, and they soon persuaded the king to dismiss his able minister

From this time on things went from bad to worse, and finally Louis XVI was forced to call the States General a body which had not met since 1614 Its meeting was the first step in the French Revolution (*See* French Revolution) The members of the Third Estate refused to follow the old method of voting, and finally declared themselves a National Assembly

At first the king seemed inclined to work with the Revolution and try to remedy conditions in the country But the influence of the queen and of the courtiers proved too strong for his feeble will Encouraged by them, he disregarded the promises he had made, and sought to flee from France, so that he might obtain aid against the revolution from Austria

This attempted flight was the beginning of the end The people saw that they could not trust the king and the "Austrian woman," as they called the queen His disregard of his promises to abide by the constitution led to the storming of the royal palace of the Tuileries on August 10, 1791

The king and his family escaped before the mob arrived, and took refuge in the hall of the Legislative Assembly That body declared the king to be suspended from office, and ordered that he and his family should be imprisoned They then called a new assembly (the Convention) which decided to abolish the monarchy, and declared the king deposed They then brought Louis XVI to trial on the charge of combining with foreign countries for the invasion of France Almost unanimously Louis Capet, as he was now called, was declared guilty and was sentenced to death The next day he

LOUIS XVI AND HIS QUEEN FLEE FROM THE REVOLUTION

In June, 1791, Louis XVI and Marie Antoinette, his wife, with their children, attempted to escape from Paris, where they had been held virtually captives in the Tuileries This contemporary aquatint shows the detection and arrest of the fugitives at Varennes—almost on the Netherlands border, at eleven o'clock at night A retired soldier recognized the king from his portrait on a treasury note and gave the warning The royal family was brought back to Paris the following day

Bibliothèque Nationale Paris

was beheaded His son, the little Dauphin, who perished mysteriously in prison, is counted as Louis XVII, though he never ruled

Louis XVIII (1755–1824) When the Bourbons were restored to the throne of France by the Allies in 1814, the younger brother of Louis XVI assumed the crown as Louis XVIII The difficult task of reconstruction was before the king, but he seemed admirably adapted to meet the situation, although he was a lazy man, his one ambition was to keep his throne

This ambition seemed likely at first to go unfulfilled, for in 1815 Napoleon escaped from his exile in Elba, and Louis XVIII forthwith fled in a panic from France At the end of the Hundred Days, however, Napoleon was again overthrown, this time at Waterloo, and the Allies entered Paris, "bringing Louis XVIII in their baggage"

Until 1820 the king was able to resist the demands of the extreme royalists for vengeance, and to build up his kingdom Finally, however, under the leadership of his brother, they became too strong for him His yielding to their demands for a reactionary government marks the beginning of the end of the Bourbons, for ten years later, under his brother, Charles X, they were driven finally from the throne of France

Louis Philippe (1773–1850) Having in 1830 disposed of the Bourbons, the French had to set up a new government Influenced by Lafayette (*see* Lafayette), they decided to keep France a monarchy, with Louis Philippe, a member of a family related to the Bourbons, as king

Louis Philippe was known for his democratic ideas, and was given the title of the "Citizen King" He walked the streets of Paris alone, carrying a green umbrella and talking with strangers, and his children were sent to the public schools But his government was undemocratic, and the people were no better off than before Only the wealthy had profited by the Revolution of 1830 Demands for a more Liberal government were refused by Louis Philippe and his minister Guizot

When, finally, the government forbade a reform banquet which was to be held on February 22, 1848, the Republicans of Paris revolted Guizot was forced to resign, but this

LOUIS PHILIPPE TESTS HIS POPULARITY

After the July Revolution of 1830 the French set up a new government, naming the duke of Orleans (later King Louis Philippe) as lieutenant-general of the realm "The Citizen King," as he was later called, decided to test popular opinion on his acceptance of the office—by driving through Paris from the royal palace to the Hotel de Ville, the headquarters of the Republican government This painting by Vernet shows the beginning of this perilous journey, which was carried through successfully

Musée de Versailles photo Neurdein

did not satisfy the rioters, and Louis Philippe abdicated on February 24, and named as his successor the Comte de Paris, his grandson, whom the Chamber of Deputies refused Then he fled to England, where he died two years later

Louisiana, (Pron lōō-iz-i-ah'-na), U S A This American state lies to the west of the Mississippi for the last 600 miles of its course into the Gulf of Mexico It includes the wide delta of the river, on which stands the city of New Orleans (*q v*), and also a smaller district to the east of the main stream, including Baton Rouge (population, 30,700), the State capital The whole surface of the state, which is generally flat and fertile is criss-crossed by minor waterways

Louisiana (area, 48,500 sq miles) produces sugar, rice, and cereals in abundance It has had an eventful career, being at first (1682) a French province, then Spanish, French again in 1800, and finally part of the United States by the Louisiana Purchase of 1803 The population is over 2,101 000, of whom some 775,000 are of negro blood

Louth, Co of Eire Although the smallest county in Ireland and covering only some 320 square miles Louth is one of the comparatively rich counties of Leinster The soil is good, the land pleasantly undulating and well farmed Lead ore is worked on the boundaries of Armagh and Monaghan, the linen and tobacco industries are fairly extensive, and the deep-sea, coastal, and salmon fisheries centred at Dundalk, give employment to many In Carlingford Lough there are large oyster beds of great value This very small maritime county, washed by the Irish Sea and connected, via Greenore, with Holyhead, enjoys enhanced prosperity from its geographical situation The main Belfast-Dublin railway crosses the county from north to south, with branches to Greenore and Dundalk The population of Louth is approximately 64,000 The county town and administrative centre is Dundalk (population, 13,000) on the river Castleford Drogheda, at the mouth of the Boyne, figures in history as the scene of the Cromwellian massacres and as an early stronghold of both Danes and Normans

Louvain, Belgium 'In this dear city of Louvain, perpetually in my thoughts, the magnificent church of St Peter will never recover its former splendour The ancient college of St Ives, the art schools, the consular and commercial schools of the university, the old markets, our rich library with its collections, its unique and unpublished manuscripts, its gallery of great portraits—all this accumulation of intellectual, of historic, and of artistic riches, the fruits of the labour of five centuries—all is dust "

THE REBUILT LIBRARY OF LOUVAIN

The University Library in Louvain was one of the buildings that suffered in the destruction of the city by the Germans in 1914 But from a heap of ruins it was rebuilt after the War into the fine building on the left of this picture, libraries from all over the world contributing volumes to re-form its collection of books

So wrote Cardinal Mercier after the deliberate burning of Louvain by the German army in August, 1914—an act which, while of no material benefit to Germany, did much to rouse the anger of the Allies Over 1,200 houses in the richest sections of the city were burned

This picturesque town on the river Dyle, distant some 19 miles by rail from Brussels, with its jumble of quaint houses and general air of aloofness from modern life, seemed even before the War to belong to the past rather than to the present Its chief interest for travellers today lies in its Town Hall, one of the most beautiful Gothic buildings in the world, the restored cathedral, the famous Catholic university, at one time the most noted in Europe, and the university library, including many priceless old manuscripts and printed books A new library was built after the War, and stocked with 600,000 books Half of these were sent from Germany under the terms of the Treaty of Versailles, and half were given by sympathizers in all parts of the world

In the 14th and 15th centuries, when Louvain was at the zenith of its prosperity, it was one of the principal cloth-making centres in Europe

Since then its decline has been rapid and its population has greatly decreased Brewing and distilling, printing, and the manufacture of tobacco, lace, and starch are the most important industries The population is about 37,000.

Louvre, THE The Louvre in Paris is a treasure-house that has no rival on the earth It would take us two hours to walk without stopping through this great building, which adjoins the Jardin des Tuileries on the right bank of the Seine, and no two hours in any lifetime could be more filled with wonder and beauty

Even if it were empty, this palace of art would be famous for its own sake Some of its foundations are as old as Magna Carta, part of it was built by King Francis I, who was taken prisoner in war with Spain in 1525, and the last gallery to be finished, much nearer our own time, is not unworthy of the rest of this stately home of art This gallery alone has 16 statues of great Frenchmen and 63 groups of allegorical statues The gallery of Apollo, 200 feet long, is one of the finest halls in the world, panelled with priceless tapestries, it has in it all that is left of the crown jewels of France

The treasure of the Louvre is beyond all calculation There is one glorious collection worth £1,000,000 housed in a little room decorated at a cost of £12,000, and it was given to France by a great family that had its rise in Germany There are 3,000 ancient sculptures (including the incomparable Venus de Milo), 2,500 pictures, and many thousands of drawings by the great artists of all nations There are the best Raphaels in Europe, Titians in abundance and other masterpieces, like Leonardo da Vinci's "Mona Lisa" There are six rooms full of antiquities from Assyria and Phoenicia, five rooms full of sculptures of the Middle Ages rescued from ruined churches at the time of the French Revolution, five rooms that speak to us of "the glory that was Greece and the grandeur that was Rome," two halls with relics of the Egypt of the Pharaohs, and five rooms filled with the glorious statues that French sculptors are giving to the world in our day

Low, DAVID (born 1891) Acknowledged to be the greatest political cartoonist of the day, Low is a New Zealander by birth, and he spent the first years of his artistic career in New Zealand and Australia Coming to London, he joined the "Star" in 1919, and was soon making the town laugh with his brilliant cartoons Low's cleverness in picking out and emphasizing some peculiar characteristic of contemporary public figures, and his particular brand of satirical wit, became even more famous when he joined the "Evening Standard" in 1927, and created characters like the old "die-hard," Colonel Blimp

LOYOLA, FOUNDER OF THE JESUITS

The hollow cheeks and burning eyes of the saint in this likeness from a Rubens painting bespeak the ascetic and mystic A holy man himself, Loyola inspired holiness in others, not least in the members of the Jesuit Order (or Society of Jesus) which he founded

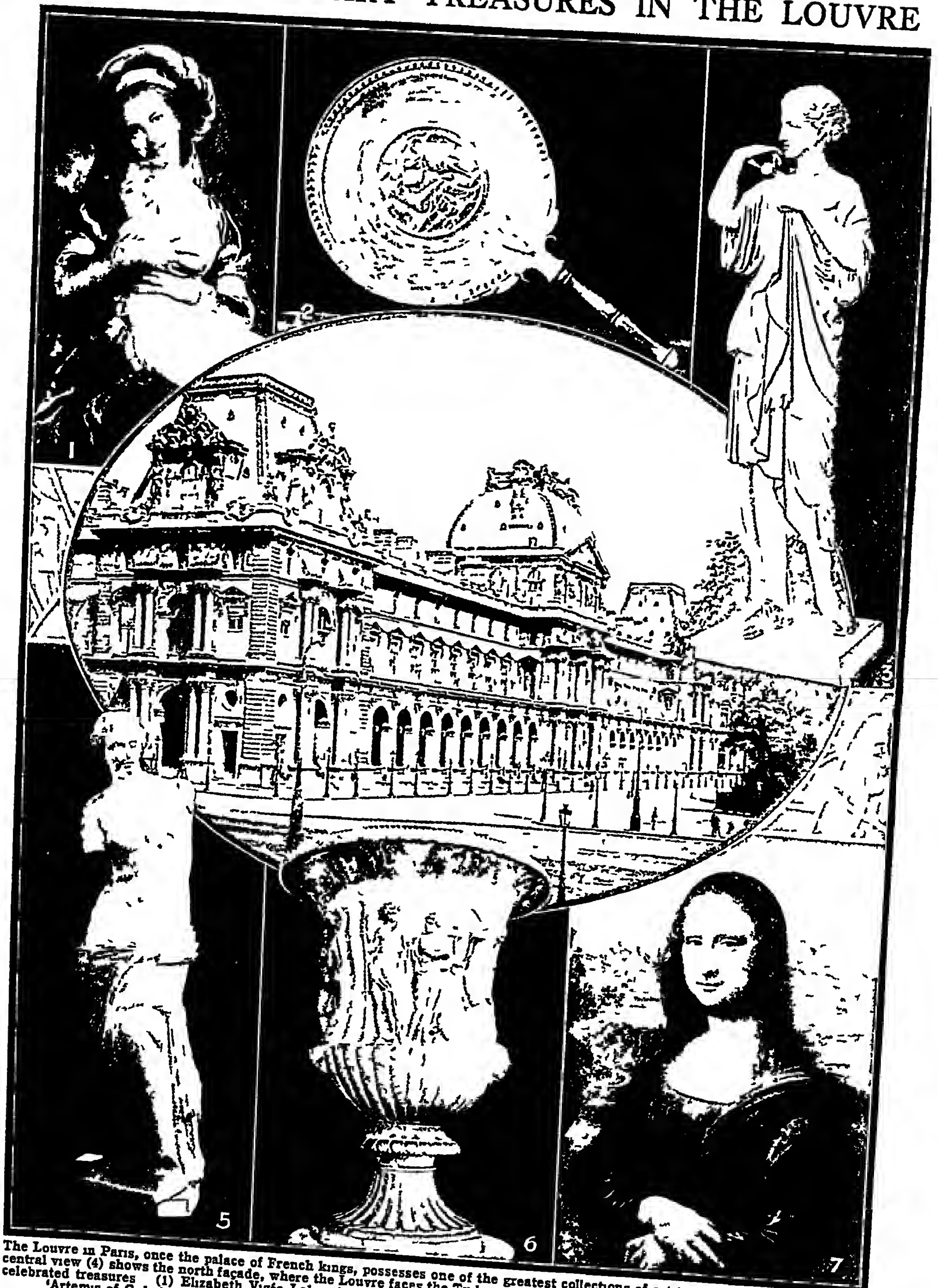
National Gallery Vienna photo F Brückmann A G

Loyola, IGNATIUS DE (Pron loi-ō'-la) (1491–1556) Until his leg was shattered by a cannon-ball at the siege of Pampeluna (1521), the future founder of the Society of Jesus was known only as a courtly Spanish nobleman and soldier

The reading of the lives of the saints during his long convalescence turned him from the quest of military glory and made him a soldier of Christ His sword and dagger he hung up on the altar of a monastery chapel His worldly garments he gave to the poor, taking a pilgrim's dress of sackcloth and hempen shoes, with a staff and gourd Seven hours a day he spent on his knees in prayer and thrice a day he scourged his wasted body

With difficulty Loyola reached Jerusalem, but he was not allowed by the authorities to remain and labour there as he had planned Back in Spain, at the age of thirty-two, he again became a schoolboy to learn the Latin needed for his religious studies The next ten years he spent at schools

SOME OF THE ART TREASURES IN THE LOUVRE



The Louvre in Paris, once the palace of French kings, possesses one of the greatest collections of art treasures in the world. The central view (4) shows the north façade, where the Louvre faces the Tuileries gardens. The other pictures show a few of the more celebrated treasures: (1) Elizabeth Vigée Lebrun's portrait of herself and daughter (2) ancient mirror (3) ancient statue, the 'Artemis of Gabii', (5) Venus de Milo (6) Borghese vase (7) 'La Gioconda', or 'Mona Lisa', by Leonardo da Vinci

and universities in Spain and in Paris Again and again he was suspected of heresy

Meanwhile his plans were taking more definite form He would found a "Society of Jesus"—spiritually drilled and disciplined like a military company—to combat heresy and do missionary work in heathen countries The members should be bound by the monastic vows of poverty, chastity and implicit obedience

In 1534 Loyola and six companions formed in Paris the beginning of the powerful organization known as the Society of Jesus, or Jesuits, as they are called for short In 1540 its members received at Rome the sanction of the Pope, and Loyola became its first "general" or commanding officer The remainder of his life—he died at Rome—was employed in working out, with infinite skill, the constitution of his order, and preparing it for its conflict with the Protestant Reformation In 1622 Pope Gregory XV canonized him as St Ignatius Loyola

Lucknow, (Pron lnk'-now), INDIA When the storm of the Indian Mutiny broke in June, 1857, Sir Henry Lawrence retreated to the British Residency in Lucknow He put it into a state of defence, and entrenched the surrounding sixty acres with its outbuildings His force consisted of 1,720 men, of whom 712 were loyal Indian soldiers and 153 British civilians He had to defend 1,280 old men, women, and children, without artillery or a great supply of ammunition He died from a wound in the early part of the siege, which lasted from July 1 to September 25

On September 25 Generals Havelock and Outram with about 1,000 men relieved the defenders, now reduced to less than a thousand The combined forces could not cut their way out and the siege went on The situation was desperate Then from the top of the Residency they saw the signals of Sir Colin Campbell, the hero of "the thin red line" at Balaclava Campbell recaptured Lucknow, and on November 17 broke through and joined forces with the weary defenders in the Residency on the plateau above the city Havelock died soon after the relief

Lucknow is today a great manufacturing and railway centre, and the headquarters of a large military force There are many secular and missionary schools for European and Indian children, and a university This important town is situated on the river Gumti, mainly on the right bank, and is the tenth city of India in point of population It was at one period the capital of Oudh, and is now in the United Provinces Population, about 274,000

Ludendorff, ERICH VON (1865–1937) The son of a Prussian officer, Ludendorff was born April 9, 1865, and entered the infantry in 1882 In 1898 he joined the General Staff, where he remained until 1914, when he became quartermaster-general of Bulow's 2nd army in the field

On the death of the leader of the 14th infantry brigade, he assumed its command and led it on the assault at Liége, receiving the surrender of the citadel, which he had thought was already captured For this daring exploit he was sent as Hindenburg's chief of staff to the Russian front, where he was largely responsible for the great victory of Tannenberg and for the overwhelming successes of 1915 He planned an advance into the Ukraine in 1916, but was overruled by Falkenhayn, who decided on the attack upon Verdun The failure of this attack, however, led to the appointment of Hindenburg to the supreme command, Ludendorff becoming first quartermaster-general

With his chief he reorganized the German army and planned the strategy by which the combined Austro-German armies overran Rumania, while holding the French front defensively with greatly inferior numbers In 1917, after the completion of the

LUCKNOW'S RELIC OF THE MUTINY — H Stokes

One of the many heroic incidents in the Indian Mutiny was the defence, against the mutineers, of the Residency or government buildings of Lucknow from July to September, 1857, at first under Sir Henry Lawrence and afterwards under Sir Henry Havelock The building is preserved as it stood after the mutiny, and the Union Jack always flies from the tower

Hindenburg Line, he arranged the retreat to it, and in the same year devised new methods of attack which used surprise to the utmost, employed gas-shells on a great scale, and supported the assault of picked shock troops by trench-mortars, field guns and machine-guns

In 1918, confronted by the failure of the U-boat campaign, which he had supported, but strengthened by the collapse of Russia, he determined on a series of offensives on the French front, the prime object of which was to destroy the British army by driving it back to the sea But although he inflicted enormous loss on the Allies, his first three offensives did not bring decisive victory, and after July 1918, the final collapse of Germany was inevitable Ludendorff fell back, hoping to hold out long enough to secure an honourable peace, but when negotiations were opened he refused his consent, and was dismissed on October 26, 1918

After the signing of the Armistice he fled to Sweden On his return he was involved in reactionary intrigues, culminating in the Kapp *putsch* of 1920, of which he was one of the organizers He next joined Hitler in the attempted Munich *coup* of 1923 Elected to the Reichstag as a National Socialist in 1924, he received about one per cent of the total votes in his attempt to become president of the Republic in 1925 His later public utterances, particularly his preaching of the gospel of "Neo-paganism," denying all Christian beliefs, were violent and increasingly damaging to his reputation for constructive work But these lapses in civil life can never belittle his reputation as a brilliant military strategist He died December 20, 1937

Dorien Leigh

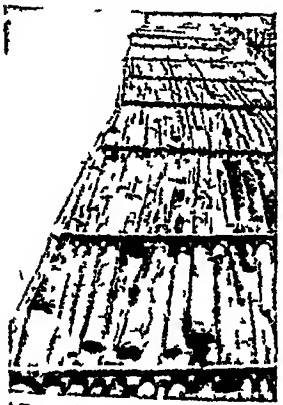
GENERAL LUDENDORFF

Erich von Ludendorff played an important part in German history, not only in military but also in political affairs As well as being the real victor of Tannenberg and Caporetto during the World War, he later joined Herr Hitler, and became prominent as an extreme Nazi'

TIMBER'S TALE *from* FOREST *to* FACTORY

An exciting and dangerous life is that of the lumberjack in the forests of the Canadian north, but his work is of the greatest value to mankind, as we learn in this article

Lumbering. Although timber has largely been replaced in the building of big structures by iron and concrete, the demand for it is constantly growing, for you have only to look around you, in your home or in the street, to see new articles of wood Many of these are described under their own headings, while general articles dealing with wood products include those on Furniture and Timber



'Boom' in British Columbia

B C Govt

The word "lumbering" is used chiefly in Canada and the U S A, and is applied to the various processes from opening up the forest to cutting the trees, transporting the logs, and converting them into timber

Each of the great forest regions of the world has methods adapted to the particular conditions that exist there, but it is in the northern woods of America and eastern Canada that lumbering is most picturesque Here much of the work is done when the forests are locked in the winter's ice and snow, and the lumber workers must be strong, hardy men In the spring they float the logs downstream

Lumber Camps of Former Days

Not so very long ago, a lumber camp in the northern woods was a settlement of log huts huddled together The largest of the huts would be the men's camp, which was one large room with bunks arranged round the walls two or three tiers high The cooking camp was also one large room with a huge range and cooking table at one end

Here were long tables, laid with a great array of tin plates, tin dishes, and tin cups, and knives and forks of heavy steel with heavy iron handles Then there were the stables, much

like the other shanties, but with lower roofs so that the animal heat of the horses and the oxen would help to keep them warm The blacksmith's shop, the storehouse, and the little log hut serving for the office of the camp clerk formed the minor buildings

But modern lumbering has, in all but the most remote or smallest posts, produced not a camp, but a regular lumbering town Transport facilities are so much greater that a far wider area can be covered from one centre, and such a centre can therefore be much more permanent Thus, not only have the old oxen and horses once used for lumber transport been superseded by hundreds of miles of railways, but each lumbering town has its schools, churches, cinema, shops, and all the other conveniences which might reasonably be expected where many hundreds of men with their families are working and living together

Gone are the days when the lumberjack was a man living, with a few others of his kind, far from civilization, from his womenfolk or his family, now he can safely marry and start his own home, certain that for some years at least he will be working in the same district But, at the same time, you must not get the idea that lumbering itself is any easier work For there is still an enormous amount of great physical effort, and the men must be strong, fit, and capable of working hard for long hours in the worst of weather, with the temperature perhaps fifty degrees below zero!

Electric Power Used on the Spot

Electricity, of course, has also changed the lot of the lumberjack Streams can be harnessed to provide power and light, and the electrically-operated overhead railway is now a usual means of transport for logs Moreover, you must realize that modern lumbering is organized to do as much as possible of the work on the spot Thus, often the wood is sawn up and cut into the standard lengths and sizes and prepared completely for the market quite close to where it was felled, so that, instead of several stops for various processes between forest and timber-yard, there may be only one Time and money are thus saved and the industry is speeded up

In spite of all this, the methods of felling have changed but little A tree has been marked for cutting, and notched This notch is a foot or more deep on the side towards which the tree is to fall and governs the direction of the fall So accurate are the axemen that they can drive into the ground with the fall of the tree a stake set 50 feet from its foot More usually, however, with all but the smallest trees, the felling is done by sawyers, using a long double-toothed saw, one man at each end, on the side of the trunk opposite the notch Moreover, very tall trees are actually "topped," by having the top fifty feet or so cut off, before the real task of felling is begun

When the tree falls, the branches are cleared off and the trunk is measured and cut into logs These are then hauled to the road, which was cut and levelled in the autumn Sometimes, however, the logs can be run straight on to a chute of running water, while in the more highly developed areas they are drawn off by tractors, taken by overhead cable railways, or even loaded, almost directly, on to the lumber railway When the logs are floated down a river, after the spring thaw, the men travel with them, sometimes along shore, and sometimes riding the rafts or even single logs They watch the logs closely so that they do not get caught in the rapids or form a "jam" at the bend of the stream

Log 'Booms' in the River

When the logs reach a larger river or great lake, they are sometimes formed into rafts or "booms" and towed by a tug For a long time the river Mississippi was a great highway for lumber rafts, but of late years logging has practically ceased below St Paul The river Ottawa in Canada is now the most important stream of this picturesque and adventurous type of lumbering

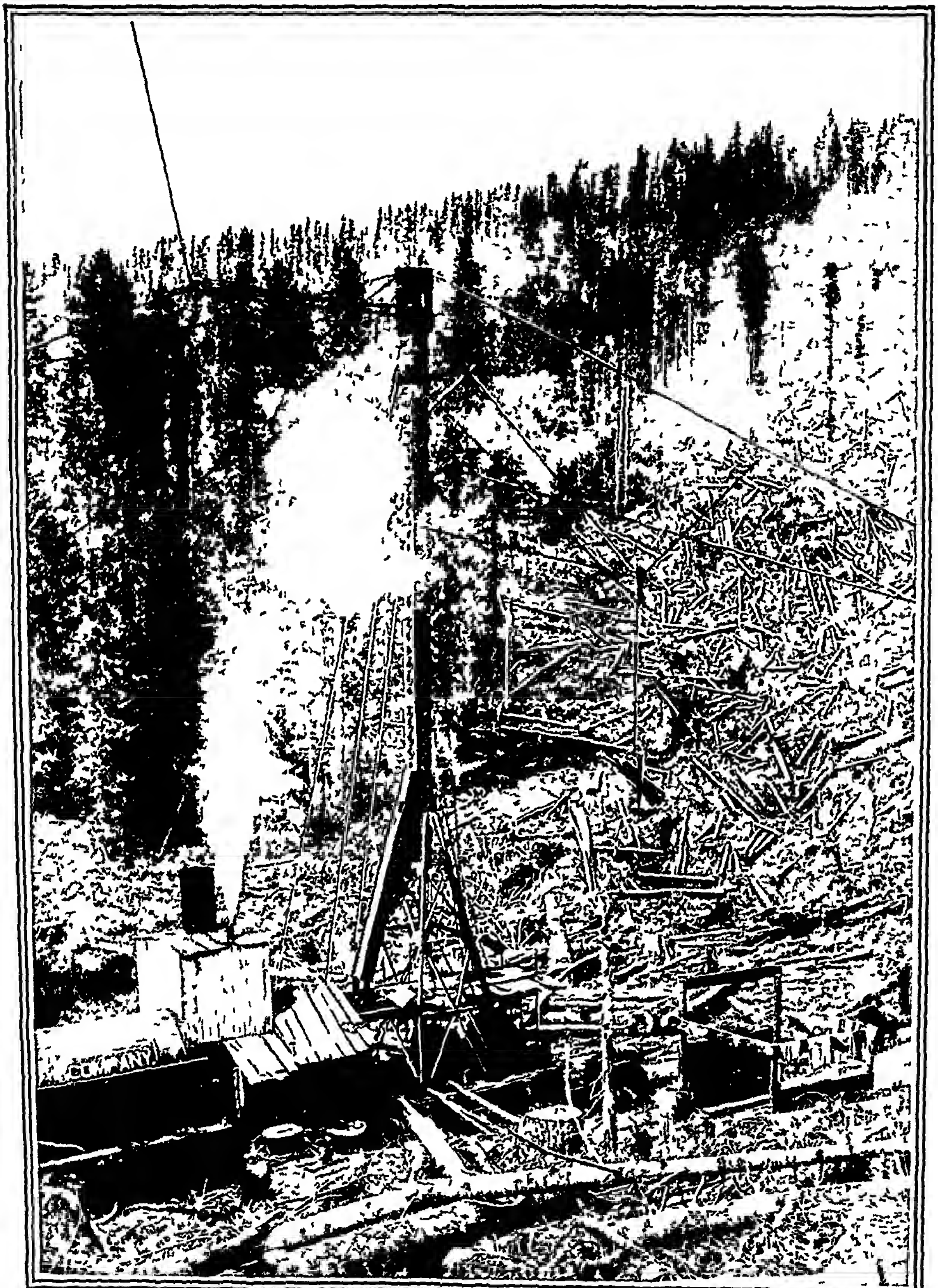
In most parts of Canada and America railways are used to handle the log supply A railway consists of a permanent main line, and spurs which are projected into the forest and are moved from time to time as the timber is taken out A steam "skidder," operating on the railway track, pulls the logs to the railway line There they are picked up by a steam loader, which is a crane with a swinging boom, and loaded on flat trucks On arrival at the mills logs are probably not needed immediately and they are therefore stored in large ponds or pools, where they will keep almost indefinitely

The Scene inside a Great Saw-mill

A great saw-mill—or "lumber manufacturing plant," as it is now more suitably termed—in operation is one of the most interesting places to visit Formerly circular saws—mounted one above and one below for big logs—were used, and it was a fine sight to see the log carriage go racing to and fro like a shuttle while the sawyer moved the levers controlling its course, and shifted the log each time with skilled judgement so that it should be sawn to the best advantage The "zip" of the saws—now high, now deep—telling of the progress of the sawing, made a music as fascinating as the spectacle

Today circular saws are used in the big mills only for trimming boards and for similar minor operations The sawing of the logs is done entirely by "band-saws," so mounted that each makes a continuous band or ellipse, travelling at a tremendously rapid speed over one wheel

THE LONG ARMS OF THE 'LOG LOADER' AT WORK

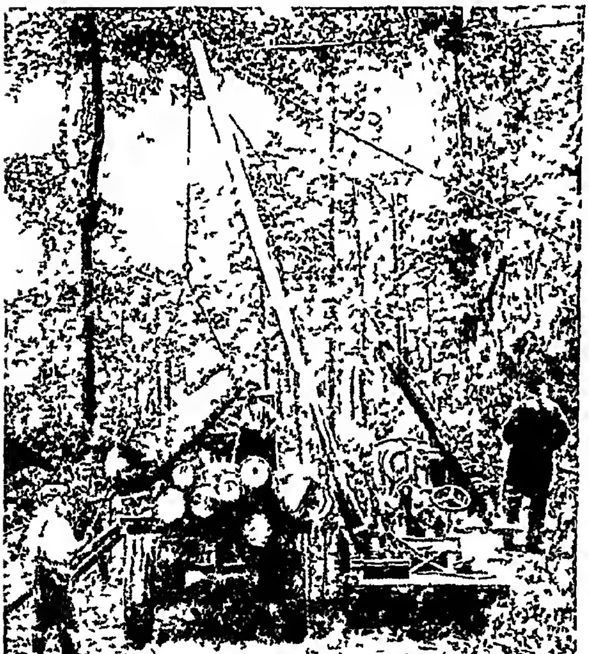


Here is an arrangement that saves climbing all over a mountainside *in order to pile the scattered logs* It consists of a simple arrangement of block and tackle Cables are carried to different points as needed, and the loader runs out along the cable picks up the logs, and brings them to a central point *From here they are sent on their way to the mill.* Thus one "set up" of the derrick and rigging collects logs from the entire mountainside, and when the space is cleared, the whole equipment can easily be moved to another location The arrangement is one of the many ways in which modern engineering helps in speeding up production in the lumber industry

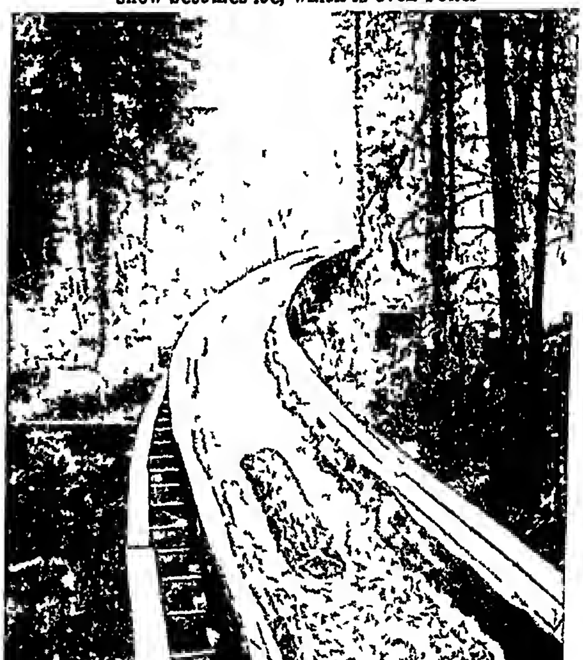
FOUR SCENES IN THE LIFE OF A LUMBER LOG

It is in the winter time when the ground is covered with snow that the sturdy lumberjacks do their work and my! what appetites they have after several hours' work sawing down trees like this. All the felled trees have been marked for cutting during the previous autumn by experts, who judge when they are ready to be made into lumber. When it is possible the trees are felled so as to lie pointing down hill. This makes it easier to haul them out.

How do these immense logs get to mill? By various routes, and, like human travellers, frequently they have to "change cars." This picture shows one of these means of travel—a wooden runway in which logs are placed and hauled down the declivities by horses. Sometimes the runway is greased, and when snow is heavy the work is easy. The first logs that pass smooth the snow and the rest slide easily, or else the snow becomes ice, which is even better.

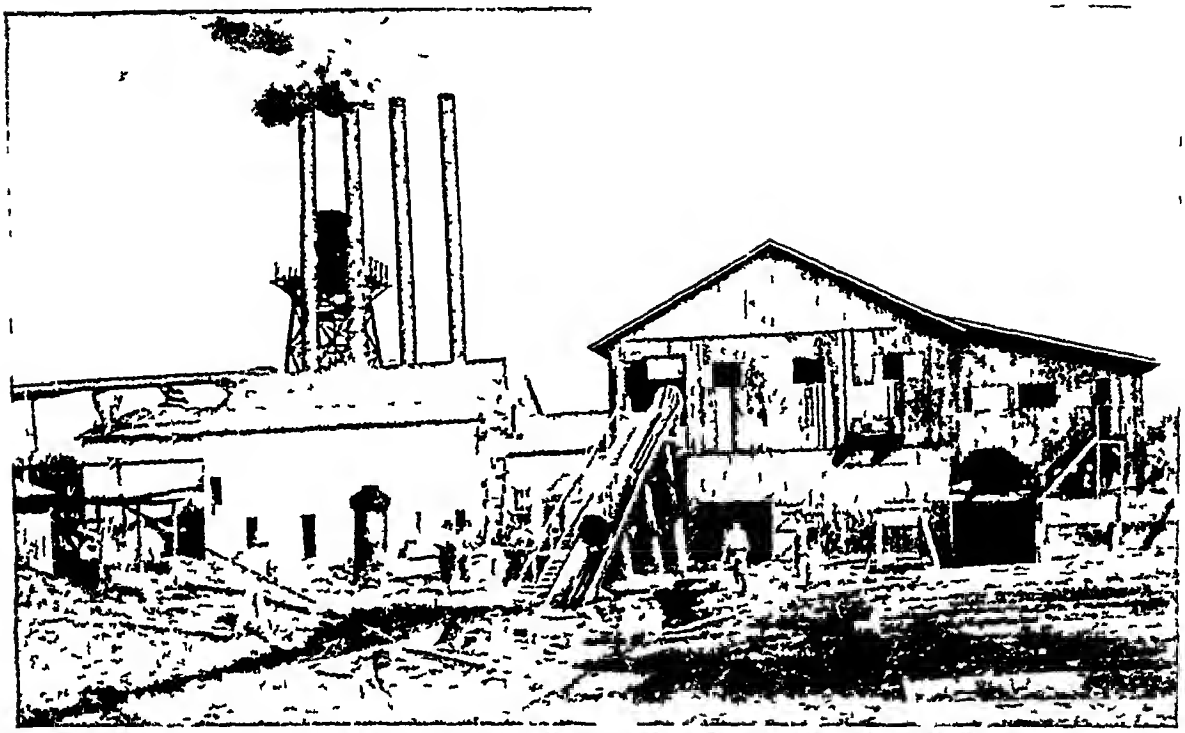


This picture shows a method of loading in the summer time. The logs are hoisted upon motor trucks by the block and tackle arrangement, called a "skidder." This skidder runs on "caterpillar" wheels. The hoisting is done by a steam engine mounted on the platform of the skidder and the logs are guided to their place on the load by two men.



Sometimes a convenient mountain stream is harnessed and made to haul logs out of the woods in the manner shown above. A sluice-way is built and the stream, or a portion of it, is turned into the upper part. Then the logs are dumped in, and rush and bump down the slide with the water until they reach the collecting point.

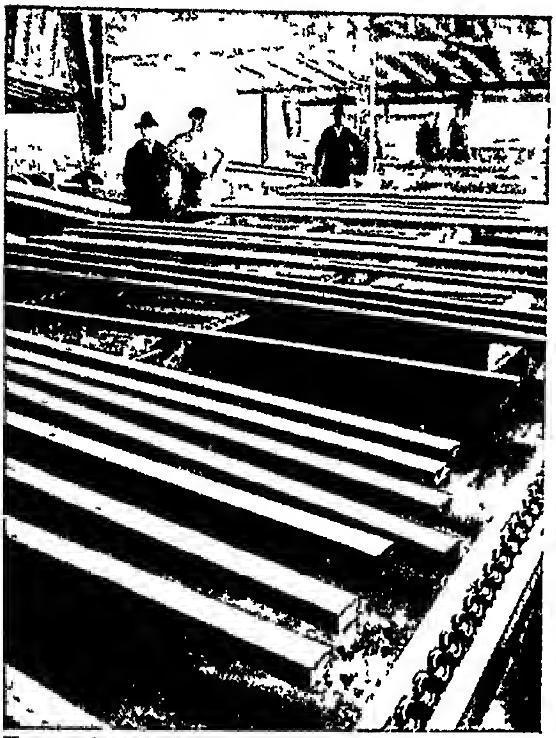
WHAT HAPPENS WHEN LOGS GET TO THE MILL



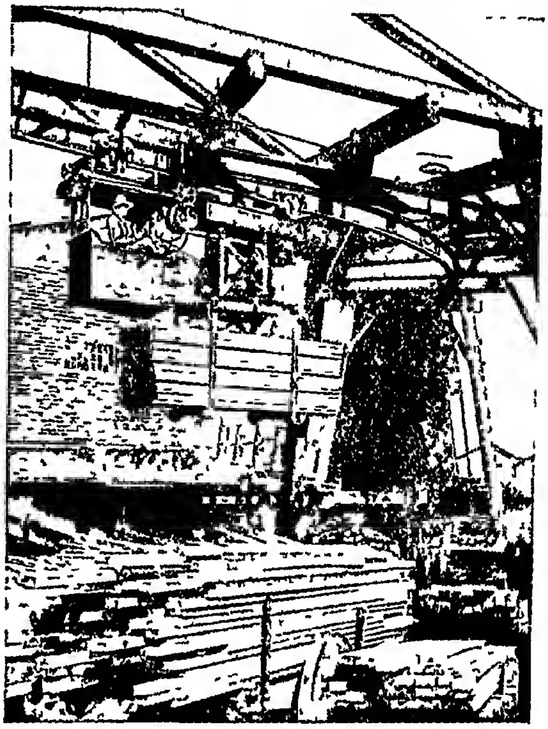
When the logs get to the mill they will climb right up the "moving stairway," just as you see this log doing here The logs with which the big saws are supplied are kept "in store" in the water at the foot of the runway, and there, with the help of a man with a long pole to guide them, they are taken from the water by an endless chain with cleats The logs rest against the cleats, and are carried up into the mill But before the saws are set to work on them these logs are given a hot bath —that is to say, they are sprayed with hot water Remember that these logs have been lying on the ground and have been dragged about more or less and the rough bark collects sand, small pebbles, and bits of stone These wouldn't be good things for the teeth of the saw to bite into

In the background is a log from which several boards have already been sliced It rides on a carriage which passes it back and forth against a band-saw, which you can see just beyond its far end The man at the nearer end uses the lever to control the machinery which turns and shifts the log on the carriage so that the planks will be cut just right Band-saws are long flexible strips of steel which run over drums like the belt of a sewing machine They work better than circular saws.

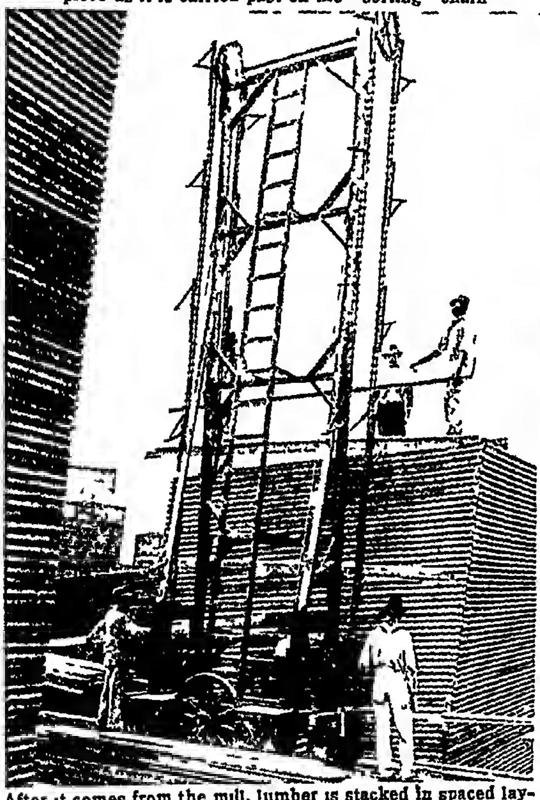
PUTTING FINISHING TOUCHES TO THE PLANKS



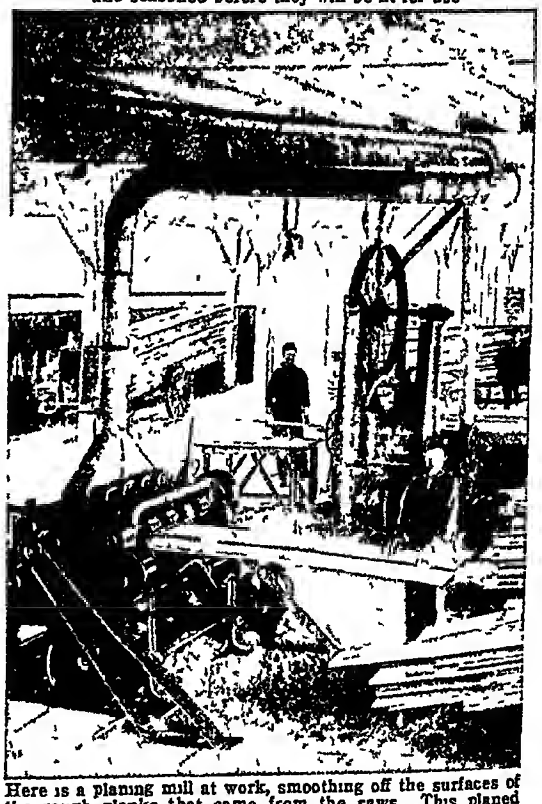
Here is where lumber passes before inspectors to be judged Lumber is graded according to its strength, durability, and freedom from knots and other blemishes If it is to be used for interior finishing or for furniture, its beauty of grain is also an important factor In the mills, experts grade the lumber, keeping in mind these qualities, and they mark each piece as it is carried past on the "sorting" chain



This curious railway up in the air is called an "overhead monorail", it carries the lumber out of the mill to be stacked and dried The trees of course had moisture in them when they were felled, and gathered even more from lying about in the snow and floating down rivers So they were soaked through when they were sawed, and the planks must be dried and seasoned before they will be fit for use



After it comes from the mill, lumber is stacked in spaced layers like this, to let the air circulate between the boards In mill yards this is done to let the original moisture evaporate, and in local yards, so the boards will dry after rain and snows In big lumber yards machinery helps in the piling



Here is a planing mill at work, smoothing off the surfaces of the rough planks that come from the saws This planed lumber is then used for floors and fine work where rough planks would not do Other machines cut tongues and grooves when desired Planed lumber is stored under cover

above and another below the saw-pit Such saws move at more than 20 times the speed of a "reciprocating saw one which moves up and down in the jig saw fashion Often a number of band saws are mounted in 'gangs,' so that the entire operation of sawing the log into boards is done with one forward movement of the log carriage

An interesting fact in regard to the circular saws of today is that they often have false teeth! It was discovered that no matter how finely the teeth were tempered and how hard the steel was made the sawing through the hardwood logs tended to break them off So saw makers now make the teeth separately and set them in the blade and when one breaks or wears out a new tooth is easily inserted

The product of the old-time saw mill was rough lumber, but now the operation usually does not stop at that point A planing mill is operated together with the saw-mill, and the lumber is cut into smooth faced boards or shaped into mouldings and like products for the building trade complete doors, window frames etc, may be made on the spot The lumber as it comes from the saw is "green" or wet and must be dried before it is shipped to market This is done by stacking it in a yard so that every piece may be air-dried, or by putting it through a steam kiln—this method, taking a few weeks at most instead of several years, is much more economical But in Britain especially there are still many who claim that to get the best out of any timber it must be naturally seasoned over a period of years

Lumber is graded according to its strength, durability, and freedom from knots and blemishes of all kinds If it is to be used for woodwork or furniture making, its beauty of grain is also an important factor "hard-woods," such as oak and sycamore, are often "quarter-sawn" so as to show the edge grain to the best advantage

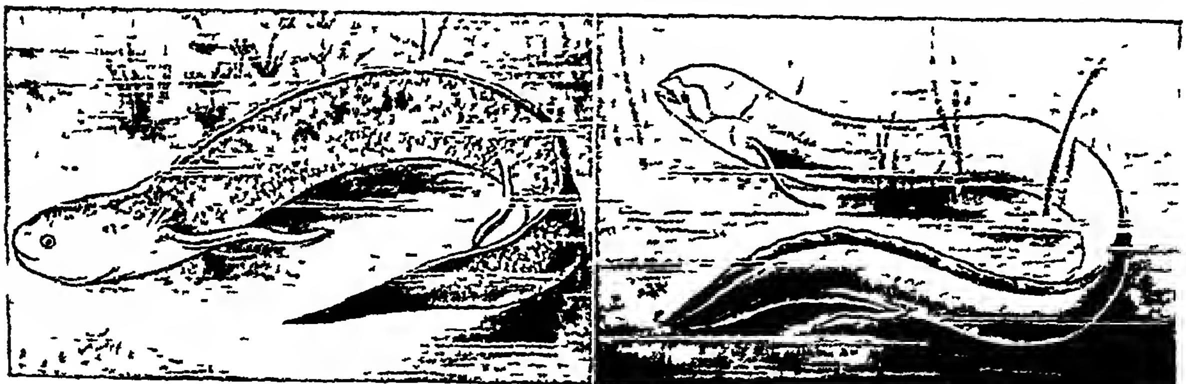
The principal varieties of Canadian lumber are spruce Douglas fir, and white pine The great tropical forests of South America produce rosewood, mahogany, and other woods valuable for furniture-making and cabinet work In the United States the principal kinds of lumber are yellow pine, Douglas fir, and oak Hemlock and white pine are also valuable woods Pine and fir are usual in northern Europe and Russia In Britain, as in the tropics, hardwoods—the timber of trees not conifers—are far more important and valuable than conifers

The forests which once covered such a large part of the world have grown smaller and smaller for they were once so immense that little thought was given to their preservation (*See* Forests Furniture, Timber, Trees)

Lung-fish. "Can a fish live out of water?" 'No,' says the "man in the street" But the curator of the Aquarium at the Zoo opens a package he has just received from far-away Africa, and finds inside a ball of dried mud It is hard to crack open, so he drops it in one of his big fresh-water tanks The mud melts away, and suddenly, out of the black mass, a long eel shaped creature uncurls, stretches, and swims happily away, looking for food

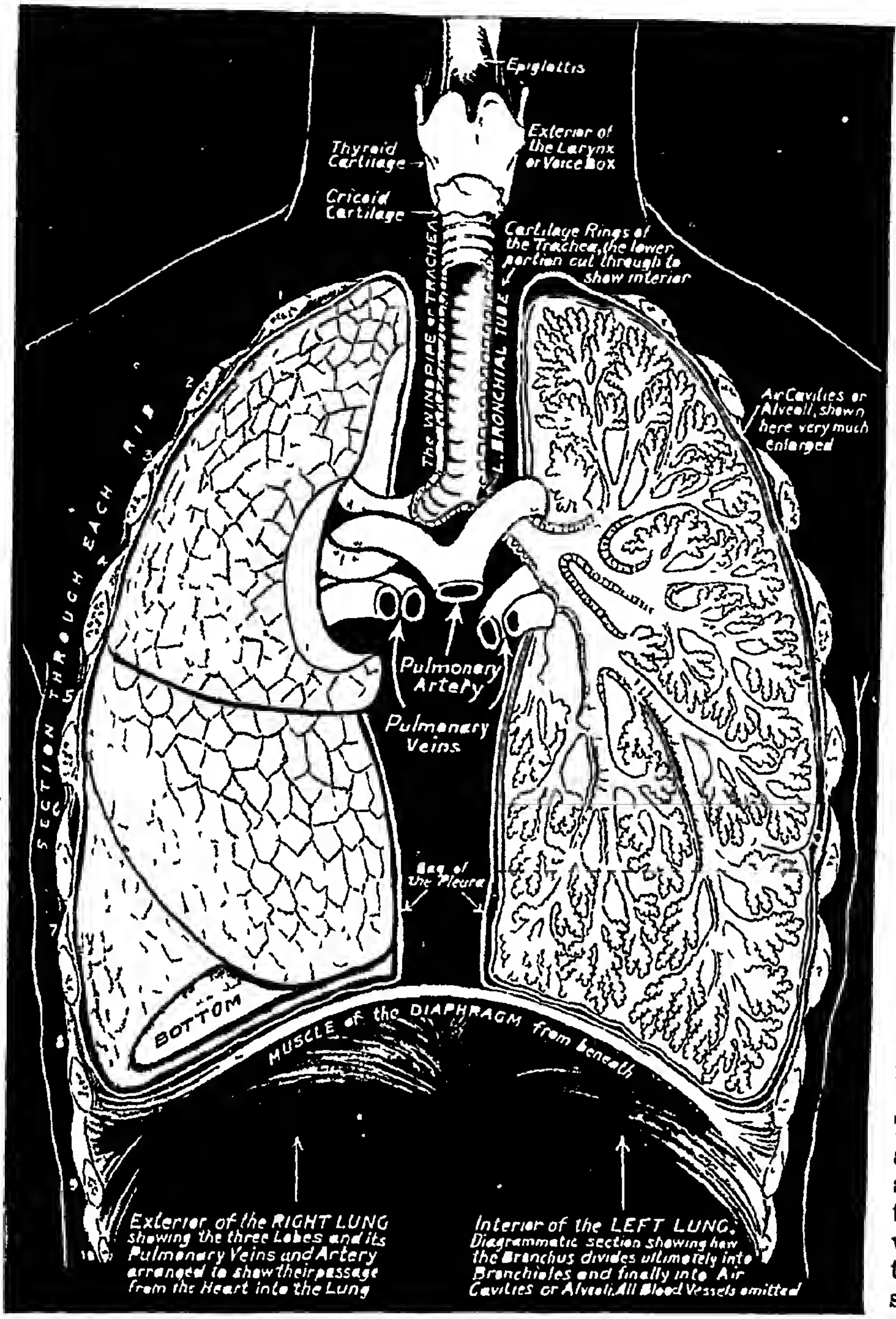
Scientists call this fish *Protopterus annectans* The negro boys in his native land probably have a shorter name for him, but he has not yet been naturalized in England, so we give his family the title of African "lung-fish" or "mud-fish" He has a close relative, *lepidosiren*, living in the South American river swamps, called by the Indian natives *lolach*, and a more distant cousin in Australia, called *barramunda*

These three fishes are what naturalists call "anachronisms"—that is, they are survivals from an earlier day, and long out of date When the world was several million years younger than it is today, this family of water creatures was very large, but these three widely scattered species are now its only living members Both



QUEER LUNG FISH AND THEIR QUEERER WAYS

Here are two members of the queer lung-fish order, which doesn t seem able to make up its mind whether to be fish or not. The African mud-fish on the left, for example, is a clever swimmer yet he often ambles about in shallow water on those pipe-stem legs The South American mud-fish on the right has a prodigious appetite, and, during the wet season, lays up fat on which he lives buried sound asleep in the mud during the dry season



WHERE WE GET AIR INTO THE BLOOD

Here are the lungs of the human body, seen from in front A small portion of the right lung is cut away to show the air tubes and blood-vessels The left lung is cut open to show its interior

uses his lungs to breathe at the surface, making a grunting noise audible at long distances

All these fishes possess front and back fins of very primitive type, and scientists think they are probably survivors of a race of creatures half-way between the true fish and the newt or salamander Although a certain number of other fishes have lung-breathing powers, they are not properly classed as lung-fishes The three we have mentioned are considered now to represent a special order, *Dipneusti*

Lungs. The human lungs are as complicated and their functions as wonderful as those of any other part of Man's amazing body The windpipe, or trachea, as doctors call it, is the main air passage to and from the lungs In the upper part of the chest cavity it divides into two main branches—the bronchi These enter the lungs, and are subdivided again and again into the bronchial tubes, which branch like the twigs of a tree The smallest divisions enter into air-sacs, which are grouped into lobules, and possess very thin walls A network

the gills, with which they breathe under water, and the air bladder (*see* Fishes) are adapted for use as lungs, and these they use when their native swamps dry up in summer, or when the mud gets too thick

The African and South American lung-fishes build mud cells for themselves, and they can then be dug up and shipped long distances in these "cocoons" These fishes are usually twelve to eighteen inches long The barramunda (*Neoceratodus*) of Australia grows much larger, sometimes reaching a length of several feet He does not build a permanent summer cell, but

of capillaries or microscopic blood-vessels is spread over the thin walls of the air-sacs, and it is in these capillaries that the exchanges between air and blood go on The blood does not come into contact with the air, but the exchange of gases is made through the thin membranes

The substance of the lungs is spongy and elastic Not only the bronchial tubes branch through the lungs, but also blood-vessels which carry blood to be aerated, and others carrying arterial blood to nourish the lungs

The oxygen received by the lungs is carried by the circulation to the minutest parts of the

distant tissues, and is there given up in exchange for carbon dioxide It is clear, therefore, that there is an *external* respiration taking place in the lungs and also an *internal* respiration taking place in the tissues throughout the body The latter is the more important part of the process of respiration, because it is in the living tissues that oxygen is used and carbon dioxide produced

The air is renewed in the lungs through the action of the diaphragm and muscles of the chest The lungs themselves are passive sacs, but they are filled and emptied like bellows by the action of the respiratory muscles In general, an adult breathes about 18 times a minute, and at each breath inhales 20 to 30 cubic inches In 24 hours this amounts to about 400 cubic feet of air Regulations and laws under housing and factory acts are enforced to ensure adequate supplies of fresh air under varying conditions (*See* Ventilation)

The FATHER *of the* REFORMATION

Perhaps you think we can owe little in these days to the priest who in the 16th century set Europe aflame with his teachings Yet had Luther not lived, the world today would be far different

Luther, Martin (1483–1546) "Here I stand, I can do no other, God help me! Amen!" These are the words which tradition puts into the mouth of the monk Luther in the year 1521, in the memorable scene in the bishop's palace of the quaint old German city of Worms, on the river Rhine, when he was called to account for his religious teachings Though it is highly probable that he did not use these words, they, nevertheless, sum up fairly well the spirit of the long and elaborate reply he made to the assembly

The young Emperor, Charles V, had just come into his German dominions from Spain, and was holding an assembly or "diet" to regulate the affairs of Germany Among other weighty topics was the question what to do with Luther, professor in the Elector of Saxony's University of Wittenberg, whose religious teachings, although formally condemned by the Pope's bull in 1520, still continued to set Germany aflame Even the Pope's representative, Alexander, who was there to demand that Luther's books be burned and their author sent to Rome for punishment, recognized that there were difficulties "All Germany is in commotion," he wrote his master "Nine out of every ten cry 'Luther,' and the tenth, if he does not care for what Luther says, at least cries, 'Death to the court of Rome!'" When faint hearted friends had counselled Luther to distrust the emperor's safe-conduct to Worms, he had replied, "Though there were as many devils in Worms as there are tiles upon the roofs, I will go there"

MARTIN LUTHER

Luther was the most powerful agent of the Protestant Reformation His rigid Puritanism and unshakable faith created a spirit which, 400 years later is still an important religious force

Pinakothek Munich

The refusal which Luther gave to the demand that he should recant was followed by the Edict of Worms, which was issued by the Emperor on May 25, 1521 It condemned Luther and called upon all persons to seize him and give him up to a heretic's death, and his books also were to be committed to the flames But no attempt was made to put this sentence into effect

Martin Luther, whose teachings thus convulsed Germany, was born of sturdy peasant stock in the little village of Eisleben, Saxony His boyhood was spent in poverty, and he sang in the streets for bread, as was the custom of poor students Later his hard-working father was able to send him to the University of Erfurt to prepare for the study of law

But as the result of an inner religious conflict Luther entered the Augustinian convent of monks at Erfurt in 1505 After three years of strict monastic discipline and theological studies, he became a professor in the new University of Wittenberg, and a few years later was in Rome on business for his order

Luther's career as a reformer may be said to begin with the nailing of his famous Ninety-five Theses to the door of the castle church in Wittenberg on All Saints' Day, 1517 Such disputations as the one contemplated were common in university life Luther's theses were an attack on the prevailing system of indulgences, and were provoked by the presence of the Dominican monk, John Tetzel, a renowned preacher and seller of indulgences

When published in pamphlet form, Luther's theses attracted much attention, and controversy

followed Cardinal Cajetan was sent as the Pope's legate to Luther, but could not induce him to retract his utterances The disputation at Leipzig with John Eck (1519) merely widened the breach In his pamphlets, "Address to the German Nobility" and "The Babylonian Captivity of the Church," Luther broke with the Roman Catholic Church In 1520 he burned the Pope's bull condemning his publicly expressed opinions, and about the same time he also destroyed a copy of the canon or Church law

While returning from the Diet of Worms, Luther was seized by the connivance of his friend the Elector of Saxony and safely hidden in the picturesque old castle of the Wartburg, near Eisenach There he remained in disguise, concealed even from most of his friends, until the emperor's preoccupation with his wars with France over Italy made it comparatively safe for him to return to his work at Wittenberg

In 1525 Luther married an ex-nun, Catherine von Bora This step emphasized his rejection of monasticism and celibacy for the clergy The remainder of Luther's life was spent in writing, preaching, and organizing the Reformed Church in Saxony His great translation of the Bible into German remains the standard German version and had an immense influence on the development of German prose, while his numerous hymns—especially "Ein' feste Burg ist unser Gott" (A Mighty Fortress is Our God)—are still in use He died at Eisleben, the place of his birth, on February 18, 1546, just as the long-deferred war to put down his teachings was about to break over Europe (*See* Reformation)

LUTHER IN THE PULPIT

Fearless courage inspired Martin Luther's denunciations of all that he considered insincere or idolatrous in religion This illustration from a contemporary German MS shows him preaching against the corruption of the Church

British Museum

Lutyens, Sir Edwin Landseer (born 1869) Whether you live in the north or the south of England, you will probably know one of the great works of this most celebrated British architect, for Sir Edwin Lutyens designed not only the Cenotaph in London's Whitehall (*see* page 287), but also the great Roman Catholic Cathedral now being built at Liverpool He has been responsible for many other great public buildings in many parts of the country, and he was, moreover, the architect for the government buildings at Delhi (page 1247), as well as for important works in the Dominions

Yet it is perhaps for his private houses that Lutyens will be remembered by posterity In an age when flats arise everywhere and new great houses are few, he has designed mansions in which the dignity, restraint, and simplicity of the Georgian period are coupled with the lightness and brightness demanded by the twentieth century But one needs to see the inside of these houses to appreciate this famous architect at his best, for it is as a designer of great staircases that Lutyens probably excels most of all Lutyens was born in London, March 29, 1869, he was knighted in 1918, and made an R A in 1920

Luxemburg. In its area of 1,000 square miles, Luxemburg has 338 miles of railway, about 800 miles of telegraph, and 142 post offices, and it is so well ruled by its Grand Duchess Charlotte and the Chamber of Deputies—54 of them—that an army of 250 and a police force of 225 men suffice to keep the peace Indeed, for the half-century before the World War, Luxemburg was one of the most peaceful spots in the world, in spite of the fact that it is bounded north, east, and south by Germany, on the west by Belgium, and for a short distance on the south-west by France

There are over 30 blast-furnaces, employing nearly 4,000 people, as well as mines of iron, copper, antimony, and lead More than half the area is given up to cereals, vines, and fruits, while the grazing tracts feed cattle, sheep, goats, and a breed of horses especially in demand for

light cavalry use The manufactures include woollens, gloves, pottery, paper, and leather

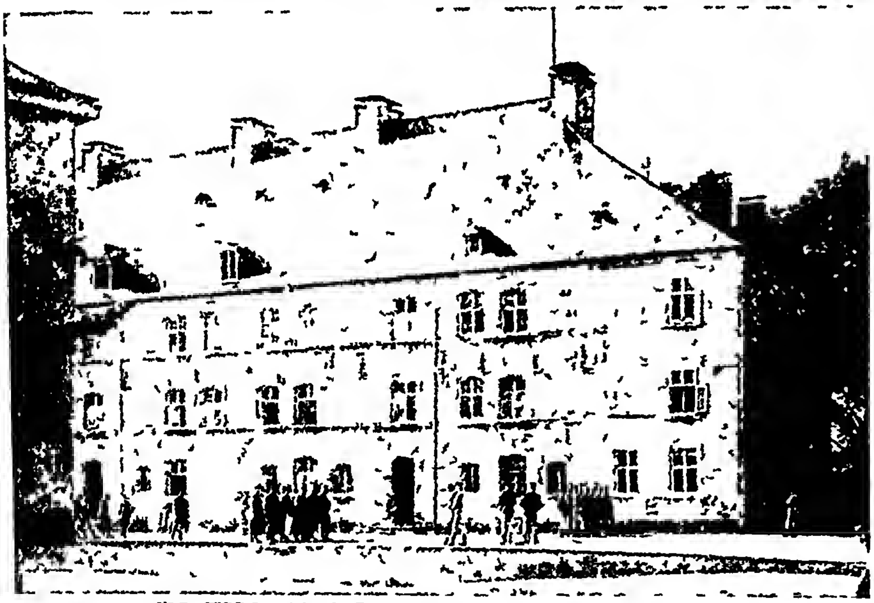
To the visitor, however, the Grand Duchy of Luxemburg is rather a beautiful bit of country-side, a paradise for the tourist who likes to go tramping It is mostly a rugged forest plateau The northern part, rising to an altitude of about 1,800 feet, forms a wedge of the Ardennes, deeply furrowed by the valleys of little winding rivers that drain into the Moselle The southern part is a lovely fertile region, as well as being the seat of Luxemburg's iron industry

The capital, the city of Luxemburg (population, 57,740), 117 miles south-east of Brussels, is one of the most picturesque towns in Europe The upper city is built on a crag 200 feet high, and was once so strongly fortified with rock galleries as to be known as the northern Gibraltar The crag rises in sheer precipices on three sides Its base is washed by two pretty little streams The upper city is connected with the lower town by flights of steps, winding streets, and viaducts

Luxemburg today is just a toy country, one of the buffer states between Germany and France Six hundred years ago it was a country of importance, for from 1347 to 1437 the Luxemburg rulers were also kings of Bohemia and supplied rulers to the Holy Roman Empire

At that time Luxemburg included also the present Belgian province of Luxemburg Since the 15th century Luxemburg has been ruled by Burgundians, Spaniards, Austrians, French, and Dutch In 1814 the Grand Duchy was created and given to the king of the Netherlands In 1839 the greater part of this became a Belgian province Although in 1867 the Grand Duchy was declared neutral territory, it remained a member of the German Customs Union down to the World War The connexion with Holland ended in 1890

In 1914, and again in 1940, Germany marched troops across Luxemburg, and further violated its guaranteed neutrality by using it as a military base Since 1922 Luxemburg has had a customs union with Belgium Many people know the country through its powerful wireless station Luxemburg's population is about 296,000



IN THE GRAND DUCHY OF LUXEMBURG

Until 1914 the people of the tiny European state of Luxemburg lived a peaceful life, undisturbed by the troubles that beset their bigger neighbours A very small army was maintained, and in the lower photograph a few soldiers are exercising in front of the royal palace The upper picture shows a landscape in Luxemburg The ox-drawn wagon moves across a hayfield lying between clumps of pine trees that are typical of the countryside

Photos E N A Doren Leigh

Lycur'gus. No really authentic facts are known about Lycurgus, the reputed founder of the Spartan state, but many stories have been told of him One such story tells us that on one occasion the great lawgiver of Sparta was fleeing for his life before a jeering crowd of his fellow-citizens A rain of stones fell thick about him, but by good fortune he outran all his pursuers except one vigorous youth As Lycurgus turned to look back, the youth thrust

at him with a staff, putting out one of his eyes The great man uttered no word of reproach Concealing the pain he suffered, he calmly waited for the mob to catch up When they saw the ill usage that had befallen the greatest man of Sparta their anger turned to dismay and shame Repentantly they escorted Lycurgus to his home and delivered the youth into his hands

Now Lycurgus gave proof of his generosity and greatness, for, instead of wreaking vengeance on the youth who had injured him, he took him into his home to live with him The young man, thus having an opportunity to observe the life of the man he had so hated, presently became one of his most devoted admirers and followers, and in time was changed from a wild and passionate enemy of the laws of Lycurgus to a sober, discreet, and useful citizen

So runs one of the stories which the Greek historian Plutarch tells us of the great lawgiver Lycurgus

Lycurgus, who, according to tradition, lived about 800 B C, belonged to the royal house of Sparta, and might have claimed the throne When the king's widow proposed to him that they should destroy the infant heir and reign in his stead, Lycurgus rejected the scheme with abhorrence, and proclaimed the child, Charilaus, king Soon after this he set out to travel in foreign lands, conversing with sages and studying the laws of the countries he visited

When he returned home after many years, he found Sparta in a state of disorder and discontent With the help of some of the leading citizens, who believed that an entire change of government was the only remedy, Lycurgus made himself master of the city and drew up a new set of laws to govern the lives of the citizens, so designed as to build up a strong state Among the measures attributed to him were the equitable division of the land among the citizens, the prohibition of gold and silver and the substitution of iron as currency, and the establishment of the strict system of military training and general education which gave Sparta military predominance in Greece

Then, obtaining a solemn promise from his fellow-citizens that they would obey the laws and change none of them until his return, Lycurgus again departed Being told by the oracle at Delphi that the Spartans would enjoy everlasting prosperity as long as they did this, he decided never to return, in order that they might for ever remain bound by their promise

Lycurgus is one of the great lawgivers of antiquity, and ranks with the legendary Manu of India, with Hammurabi of Babylonia, Moses among the Hebrews, and Solon of Athens

Lynx. So acute is the sight of the lynx that the ancients believed he could see even through a stone wall That is why we still speak of sharp-sighted people as "lynx-eyed"

This member of the cat family is found in both the Old World and the New In size it falls halfway between the leopard and the true wild cat, and in general appearance is quite unlike any other animal All species of the lynx have stumpy tails, long limbs, and upright, tufted ears Its eyes contract in the daytime to a narrow slit, for they are adapted for use at night, and if they were wide open at any other time the strong daylight would be too bright for them

Lynxes live in forests and rocky places, and are fond of resting stretched out on a tree limb in the sun By night they hunt their prey, which consists usually of birds and small animals

The sudden cry of a lynx at night is one of the most frightful sounds known Usually it consists of a single sharp howl, followed by silence The reason for this is interesting The creatures

Fox Photos

MANNERS AMONG THE LYNXES

There seems to be a polite disagreement between these two Asiatic lynxes at the London Zoo, for while one looks as if it is asking to pass along the branch, the other seems calmly determined not to move Their far northern home makes the lynxes' thick fur necessary, but the curious tufts on their ears are merely ornamental

on which the animal preys, such as rabbits or quail, seek to escape his notice by lying perfectly still The lynx crouches down all ready for a leap, and then emits his piercing cry The timid victim, startled out of its wits by the fearful sound, cannot help jumping convulsively At that instant the lynx strikes

The Canadian lynx (*Lynx canadensis*) has heavy grey fur mottled with brown, and its skin is in great demand in the fur trade It is the most important of the American species In Europe is found the northern lynx (*L borealis*) There is a Mediterranean species (*L pardinus*), and one from Tibet, while the caracal is another Asiatic member of this group

LYRE BIRD SHOWS HIS TAIL

This beautiful bird has several remarkable things about him, of which his tail is the chief To it his name is due, for in shape it is very like the lyre which was a favourite musical instrument with the ancients He is also the largest of all singing birds having a very fine voice during the breeding season

Courtesy of Australian Trade Publicity

Lyons, France The city of Lyons (in French, *Lyon*) is very old and stately, and is built where two great rivers, the Rhone and the Saône, meet Part of the city lies on a point of land between the two, and part overhangs the rivers on the high banks that are reached from the centre by twenty-four bridges and bordered by fine quays Here is a great university, where students are taught law, medicine, and science, there is also a school of fine arts, and other colleges, besides many beautiful old churches and a big municipal library

The shimmering silks manufactured here and in the villages around are used all over the world, and the weaving of them keeps 50,000 hand looms and 30,000 power-looms humming

Lyons is one of the most strongly fortified cities in France, having a double ring of forts about it, to which, fortunately, the World War never reached The town was founded before Christ by the Romans, and was the starting point of four great highways built by the Emperor Agrippa

During the 5th century it became one of the most flourishing cities of the newly-formed kingdom of Burgundy In 1312 it became a part of France Two great Church councils were held here, and several risings took place in the Middle Ages, during which the town was badly damaged But Napoleon rebuilt and improved it, and since his day it has been one of the greatest sources of the wealth of France The population is about 570,000

Lyre-bird. A bird whose tail has made him famous is the lyre-bird (*Menura superba*) of Australia Without the sixteen long and curiously shaped tail feathers of the male, this bird is not at all unusual, for both male and female are of unattractive form, about the size of a grouse, and of a sooty-brown colour with a few markings of red These tail feathers are about two feet long, generally drooping like a peacock's train, but, when raised and spread, they take the shape of Apollo's lyre

The lyre-bird is the largest of the singing birds He has a mellow liquid note, and is said to imitate the song of other birds and even animals, and when he wishes to attract his mate, he displays the glories of his tail from the top of some convenient hillock The nest is placed on the ground, at the foot of a tree or rock, and is closely woven of fine strong roots and lined with feathers About this nest is heaped an oven shaped mass of sticks, moss, and leaves,

Portrait by P F Poole, National Portrait Gallery

"Sculpture," a poem, was the first of his published works, and it gained for him the Chancellor's prize for verse at Cambridge in 1825

Although he was a contemporary of such popular authors as Dickens and Thackeray and Tennyson, Bulwer Lytton achieved world-wide fame, and his novels were eagerly sought and read all over the world His literary output was enormous, considering that, besides being an author, he was a prominent figure in society and an M P Even after his elevation to the House of Lords he continued to write

On his beautiful Hertfordshire estate at Knebworth, still belonging to his descendants, he often entertained Dickens and other great Victorians His library, many of his manuscripts, and other personal belongings, are still treasured at Knebworth House, as well as many beautiful objects brought from India by his only son, the Earl of Lytton, who was Viceroy of India

Bulwer Lytton was born May 25, 1803, and died January 18, 1873 Besides novels, he also tried his versatile hand at dramatic writing He wrote four plays, three of which were successful, "Money" and "The Lady of Lyons" still hold the stage

with a side entrance, so that the inner nest and the one egg are entirely protected The birds are very shy, and when molested escape by running rapidly in the undergrowth They are found at times in the trees, but are not good flyers

Lytton, Lord (1803-1873) One of the literary giants of the 19th century, Bulwer Lytton is still remembered today as the author of such well-known novels as "The Last Days of Pompeii," and "Rienzi," "The Caxtons," "My Novel," etc

LORD LYTTON'S 'LAST DAYS OF POMPEII'

Lord Lytton (top) wrote "The Last Days of Pompeii," a story of the time of the great eruption of Vesuvius which buried Pompeii under a sea of lava A blind flower girl, Lydia, is in love with Glaucus, and, after a vain attempt to win him with a love potion, she saves him and the girl he really loves when the city is overwhelmed, for she can find her way in darkness Here Glaucus receives the potion

Painting by W E Lockhart R S A reproduced by permission of Landeker & Brown Ltd

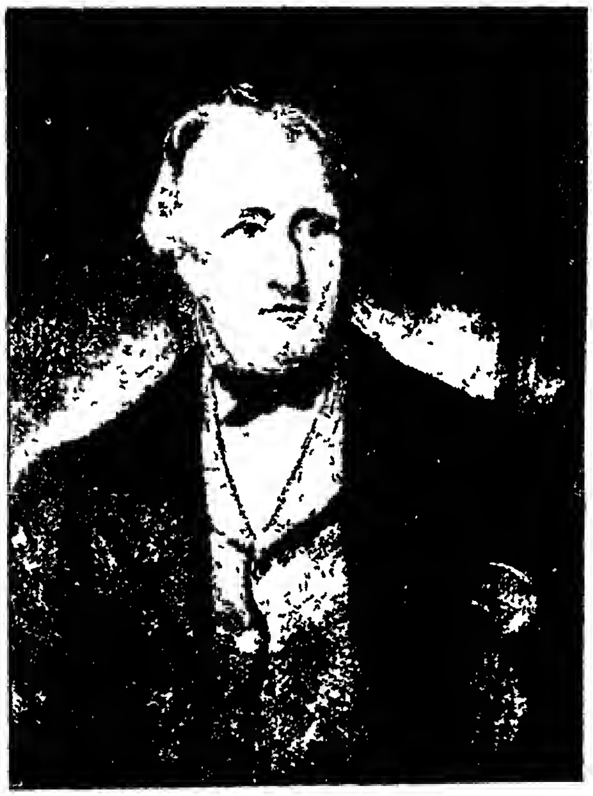
The dough is put into a cylindrical vessel having a perforated bottom, and a heavy iron plate, driven by a powerful press, forces the paste through in the desired shapes The strings of paste are then looped up over rods to dry

The next time you open a packet of macaroni or spaghetti see if the flattened mark of the rod over which it is hung is at the curve If so, it is the true macaroni, made from flour rich in gluten , for that made from other flours will not bear its own weight, and must be laid out flat to be dried True macaroni is hard and elastic, has a soft yellowish colour, and is rough in texture In boiling it swells considerably

Macaulay, Thomas Babington Macaulay, Lord (1800-1859) As a child of three, books were Macaulay's constant companions At four he replied to a lady who inquired how he felt after some hot coffee had been spilled on his legs, "Thank you, madam, the agony is abated" He was a brilliant student at Cambridge University in every subject except mathematics He learned to read books in Greek, Latin, French, German, Spanish, Italian, and Dutch

Macaulay's wide knowledge and his marvellous memory made him a very interesting speaker, for he never ran out of material and he was always sure of his facts Lord Melbourne, one of his colleagues in Parliament, said of him, "I wish I were as cocksure of anything as Macaulay is of everything" The remark contains a sting, for Macaulay was never bothered by doubts and never speculated on the unknown Everything stood out in the blazing light of day for him and there were no half-lights He read books of all kinds, good and bad, for he knew how, as his biographer says, to weave ' a purple patch from some third-rate sermon or political treatise" into his inspiring talks or essays

Macaulay's father, Zachary Macaulay, was a well-known reformer, whose lifelong opposition to African slavery wrecked the family fortunes His son studied law and was admitted to the bar, but soon turned aside to follow the career of literature In August, 1825 appeared his essay on Milton, the first of a series which for 20 years made him and the "Edinburgh Review" famous No more delightful introduction to history can be found than these brilliantly written and intensely interesting stories of the lives of great men—Warren Hastings and Clive, Pitt and Bunyan, Dr Johnson, Lord Burleigh, and the rest The world of fashion and of letters now learned that this young man could write as brilliantly as he talked



LORD MACAULAY

The life of Lord Macaulay written by his nephew shows him to have been a man of deep and warm affections, and a devoted son and brother This portrait of Macaulay by Sir Francis Grant is in the National Portrait Gallery, London

Macaulay's gifts as a writer and speaker led him naturally into public life In Parliament, and later in India, as legal adviser to the supreme council, he showed gifts of mind that always held men's attention In politics he was a Whig, striving for a wider voting franchise and far-reaching Liberal reforms He was pleased, however, with the material progress of the time and closed his eyes to what he considered necessary economic evils

But during all the busy years of his official life, when writing was just an occasional pleasure and source of income, Macaulay was planning a history of England to begin with the accession of James II to the throne—a history, as he said, interesting enough "to supersede the last fashionable novel upon the dressing-tables of young ladies" He began it in earnest in 1841, and in 1849 finished the first two volumes Later volumes appeared from time to time, but the work was still uncompleted when Macaulay died, just ten years later

Macaulay's history had an immediate success —greater perhaps, than that achieved by any other history It had a tremendous sale in England and the United States, and was translated into all modern languages Macaulay had worked at it with ungrudging toil He wrote in his diary at one time "This is a tough chapter What trouble these few pages cost me ! The great object is that they may read as if they had been spoken off and seem to flow as easily as table talk" His paragraphs achieve their aim, and sweep the reader along

For a generation Macaulay was read with enthusiasm and respect In the generation that followed, his fame was not quite so great His brilliance, his power of painting a picture or narrating an incident, are still unsurpassed , but his insight into the complex character of men and of movements left something to be desired He saw men's outward actions, but he could not divine their inner motives He viewed history as a great pageant, a series of pictures in which the doings of the people great and small appear for the first time along with the chroniclings of court, camp and Parliament What Scott did with the romantic novel, Macaulay did with narrative history He made it interesting, first of all, to the average man and woman, and he set a new fashion So highly was his work appreciated that a body of English workmen wrote to thank him for writing a history which they could understand

Quite as popular as Macaulay's essays and his history was a little volume of poems entitled "Lays of Ancient Rome" These still delight old and young, not merely from their historic interest, but because of their stirring melody

In 1857 Macaulay was made a peer with the title Baron Macaulay He lived to enjoy this new honour only two years When he died, at the end of 1859, the greatest honour that England can show to her illustrious dead was conferred upon him, for he was buried in Westminster Abbey

Macaw. The gorgeous macaws are close relatives of the parrots, but are even larger and more brilliantly coloured One of the finest is the blue-and-yellow macaw (*Ara ararauna*) and other favourites are the red-and-blue *A macao* and the various hyacinthine macaws, brilliant blue creatures, These birds are found in the northern half of S America and in Cuba They have a loud screaming voice Macaws lay their eggs in holes in rotting trees

Macbeth. This hero of Shakespeare's powerful tragedy of that name is in command of the armies of Scotland when the play opens, and has just won a great victory over the Danes The triumph so fires his ambition that witches, bent on evil, easily implant in his mind the thought that he shall be king Lady Macbeth still further incites him, until with his own hands he murders the Scottish king Duncan and usurps the throne From that very moment Macbeth goes swiftly to his doom Ghosts rise to haunt him, Lady Macbeth dies insane, civil

MACBETH AND BANQUO MEET THE WITCHES

Macbeth's encounter with the witches is depicted in this painting by Jean Corot, the famous French artist It shows Macbeth and Banquo emerging from a wood on to the 'blasted heath' and meeting the 'weird sisters' Macbeth was hailed by two of the witches in turn as Thane of Glamis and Thane of Cawdor while the third cried, "Thou shalt be king hereafter Before Macbeth could get an explanation of these strange sayings, the witches vanished

Wallace Collection

war breaks out, led by Malcolm, the son and heir of the murdered king, and, finally, he himself is slain in battle Macbeth is to be abhorred for his crimes, but in all that he does and says he excites a tragic pity, as when, informed of the death of the queen, he thus gives utterance to his gloomy thoughts

> Tomorrow, and tomorrow, and tomorrow,
> Creeps in this petty pace from day to day
> To the last syllable of recorded time,
> And all our yesterdays have lighted fools
> The way to dusty death Out, out, brief candle!
> Life's but a walking shadow, a poor player
> That struts and frets his hour upon the stage
> And then is heard no more it is a tale
> Told by an idiot, full of sound and fury,
> Signifying nothing

The story of the play is taken from history, the real Macbeth having ruled over Scotland from the year 1040 to 1057 He was thane of Glamis, and his castle is the ancestral home of our present Queen Elizabeth

Macdonald, FLORA (1722–1790) In the roll of Scottish heroines, Flora Macdonald, to whose ingenuity, courage, and loyalty "Bonnie Prince Charlie" owed his escape after Culloden, April 16, 1746, occupies a high place

Charles's defeat was so complete that his loyal Highlanders—the Jacobites as they were called, after his grandfather James II—were scattered and pursued remorselessly and put to the sword by the troops of the English commander, the Duke of Cumberland, whose ferocity and cruelty earned for him the name "the butcher" The Prince became a hunted fugitive, sleeping by day and fleeing hither and thither by night in the seemingly vain hope of escaping through the military cordon and evading the numerous parties of soldiers who were searching the Highlands to bring him to London "dead or alive" and so claim the price, £30,000, which the English placed on his head And just as all seemed lost, after six long weeks of fatigue, hunger, and anxiety, there arose to rescue him Flora Macdonald

She made the Prince dress in woman's clothes, pose as her servant, and accompany her in an open boat from the mainland to the isle of Skye, where she would conceal him among relatives With skill, luck, and great courage their frail craft was made to evade the English ships, then patrolling the Scottish coast, and, although several shots were fired to bring them to, they landed safely in Skye Here, with her supposed maid, she dined with Lady Margaret Macdonald, at whose table sat an army officer, stationed here with a party of soldiers, to watch for Prince Charles should he attempt to land! When Dr Samuel Johnson visited Skye in 1773, Boswell relates in his "Journal of a Tour to the Hebrides" how, when Flora Macdonald told him of this episode, she added that she afterwards (when the Prince was safe) often laughed in good humour with this officer at having so well deceived him!

Shortly afterwards the Prince escaped to France, and Flora Macdonald was taken to London and there detained In 1747 she was released under the Act of Indemnity, and her admirers presented her with £1,500 in token of her loyalty and courage to the ill-fated House of Stuart

FLORA MACDONALD AND PRINCE CHARLIE
During the escape of Prince Charles under the guidance of Flora Macdonald he had many narrow escapes from capture At one time the party were forced to take refuge in a small cave on the island of Skye This picture, painted by T Duncan, shows Flora and her attendants keeping watch while the Prince sleeps

MacDonald, JAMES RAMSAY (1866–1937) Born in a two-roomed cottage at Lossiemouth, October 12, 1866, and taught at the local elementary school, the first British Labour Prime Minister displayed from his earliest days of poverty that moral courage which later endeared him to an army of admirers, and drew forth the respect of his bitterest opponents

When but an inexperienced boy he journeyed to London, obtained a job in a warehouse at 12s 6d a week, almost starved, and attended evening classes He studied chemistry, but just when a scholarship was almost within

reach, his health broke down. Over-study and underfeeding had exacted their price.

Then fortune smiled on him, rather faintly at first. He became secretary to a Parliamentary candidate at what he then, no doubt, considered the princely wage of thirty shillings a week. And so he first joined the Independent Labour Party, and science was abandoned for politics. The future Prime Minister next tried his hand at writing for newspapers and was successful. He stood for Parliament as a Socialist, polled a mere 866 votes, lost the election, but gained a wife. Her name was Margaret Ethel Gladstone, the daughter of a professor and a niece of Lord Kelvin. Never was married life more happy. Her death in 1911 left its mark on a man intensely devoted to his home and his children. Her philanthropic work on behalf of poor London children is very fittingly commemorated in a beautiful sculpture erected in Lincoln's Inn Fields, London, near the home of her married life.

Wide World Photos

RAMSAY MACDONALD SPEAKING AT GENEVA

As an orator Ramsay MacDonald carried his audiences with him in speeches notable for the conviction which underlay them. His delivery was slow and measured, and his voice was powerful. He is here seen speaking at a gathering of journalists at Geneva, when the League of Nations was sitting.

Elected Member of Parliament for Leicester in 1906, Ramsay MacDonald was chosen leader of the Labour Party in the House of Commons five years later. During the World War he became one of the most unpopular men in England owing to his opposition to the War and advocacy of a negotiated peace. In 1918 he lost his seat in the House, but returned in 1922.

In 1924 MacDonald was called upon to form the first Labour Government, which lasted less than a year. He became Premier for a second time in 1929, but in 1931 a grave financial crisis, accentuated by world trade depression and rising unemployment, brought about the defection of most of his colleagues, who refused to accept the Economy Report, advising drastic cuts in national expenditure, which Sir George May's Committee advocated. MacDonald remained true to his beliefs in the nation's recovery powers, provided sacrifices were made, and after consulting with Stanley Baldwin and obtaining the support of the Conservatives, he became head of the National Government. In June, 1935, he resigned, Baldwin taking his place.

A profound believer in peace, he was the first British Premier to address the Assembly of the League of Nations at Geneva. The first task of European statesmen, he told the German Reichstag in 1928, was to persuade their peoples to prefer the risks of peace to those of war.

The heavy burdens of office, no less than the loss of political friendships, which he endured when he allied himself with the Conservative party to restore Britain's financial prestige, told on his health, and before resigning the Premiership he had undergone several operations on his eyes. He became a lonely and tired if not disappointed man, and in an endeavour to regain his health, and grasp what he called "that elusive quality, rest," he embarked on a tour to South America, hoping to write his political memoirs in the leisure of a well-earned peaceful holiday. But after only a few days at sea he died from heart failure, November 9, 1937. His body was brought back in a warship to be buried at Lossiemouth, his first and last home.

Macdonald, Sir John Alexander (1815–1891). Macdonald went to Canada at five, a poor Scots immigrant boy. Poverty ended his schooling at fifteen, but his insatiable curiosity and love of reading soon made up to a large degree for the lack of formal education. Entering a lawyer's office, he was admitted to the bar at twenty-one, and eight years later was elected to the Canadian Assembly. Almost at once he became one of the leaders of the Conservative party, winning Cabinet office in three years.

By 1864 the union of Upper Canada (Ontario) and Lower Canada (Quebec), formed in 1841, was fast drifting into chaos through party warfare and racial and religious jealousies. Macdonald's political tact made him the leader in the momentous negotiations which resulted in the establishment of the Dominion of Canada in 1867. He, too, was largely responsible for the adoption of the principle of centralization,

whereby powers not specially conferred on provinces are reserved to the central government

For his share in the great achievement of federation Macdonald received two signal honours—he became the first Premier of the new Dominion, and was made K C B by Queen Victoria Macdonald's first premiership lasted from 1868 to 1873, when he had to resign In 1878, however, he was back at the helm, where he remained until his death

Macedonia. Scarcely a relic is left today of the period of Macedonia's greatness, when, under Philip of Macedon in the 4th century B C, it suddenly shot up to the mastery of Greece (*See* Alexander the Great)

As a territorial and political unit Macedonia is only the name given to that little region of the rugged Balkan peninsula where Greece, Bulgaria, and Yugoslavia meet, with a population of only between 1,000,000 and 2,000,000 In this region dwell such a strange medley of races as can be found in few places in the world—Turks, Slavs, Greeks, Bulgars, Jews, Albanians, Vlachs, and Circassians

During the closing years of the 19th century and the opening years of the 20th the history of Macedonia was a series of intrigues by the more powerful races, each striving to gain the upper hand and to dominate the region when it should shake off the merciless hand of the Turk, who had held it since the 15th century The Balkan wars of 1912–13 were waged largely for the possession of Macedonia and the outlet to the sea it affords (*See* Balkan Peninsula)

At the close of the Balkan Wars and the World War of 1914–18 the greater part of Macedonia was divided between Greece and Yugoslavia Bulgaria retained only a small strip along the river Struma After a few years Greek Macedonia became populated almost entirely by Greeks, through exchange of populations with Turkey, but Yugoslav Macedonia was still a racial problem Yugoslavia classed this population as Serb, but many of these people called themselves Bulgars Bulgaria for years had been the centre of a movement for Macedonian independence, and after 1919 large numbers of Macedonian revolutionists fled to Bulgaria From there they conducted border raids, organized in bands called *comitajis*

Machiavelli, NICCOLO (Pron mak-i-*a*-vel'-i) (1469–1527) This Italian writer and statesman has had a most unenviable reputation for some four centuries, and his name is commemorated in the English language by the word Machiavellian, meaning "unscrupulous"

He was born May 3, 1469, at Florence, then a republic Entering the diplomatic service of his country as a young man, he soon distinguished himself by his astuteness and ability, and became a very prominent statesman, being entrusted with many negotiations of an extremely delicate character When a change of rulers ultimately deprived Machiavelli of his high offices, he devoted himself to authorship, and wrote a number of very important works, including a history of Florence

NICCOLO MACHIAVELLI

This Italian statesman had a profound influence on the political thought of the 16th century, and he has been called the founder of modern political science This fine portrait of him was once in the possession of the family into which Machiavelli's daughter married

He is remembered now mostly on account of his book "The Prince," published after his death, by which he had apparently hoped to bring himself again into favour with the Medici, then the rulers of his country In this he was not successful, and he had experienced prison and poverty before his death, June 22, 1527 His main theme was that the State should be supreme, and that all means of making it supreme were justified He praised private virtue, but saw no need of such virtue in public and political matters His views have been generally condemned, and it is now realized that national affairs must be governed by a sense of right and wrong

Machine-gun. The great importance which the machine-gun now has is due to its tremendous speed of firing, its lightness, and its convenience of handling Some machine-guns are light one-man guns, fired from the shoulder, and are more properly styled "automatic rifles" Others are heavy guns, mounted on a low tripod or a light carriage, and requiring two or more men to operate them In some the cartridges

are fed from a belt, in others from a disk or other magazine The heavy guns are usually water-cooled, the light air-cooled

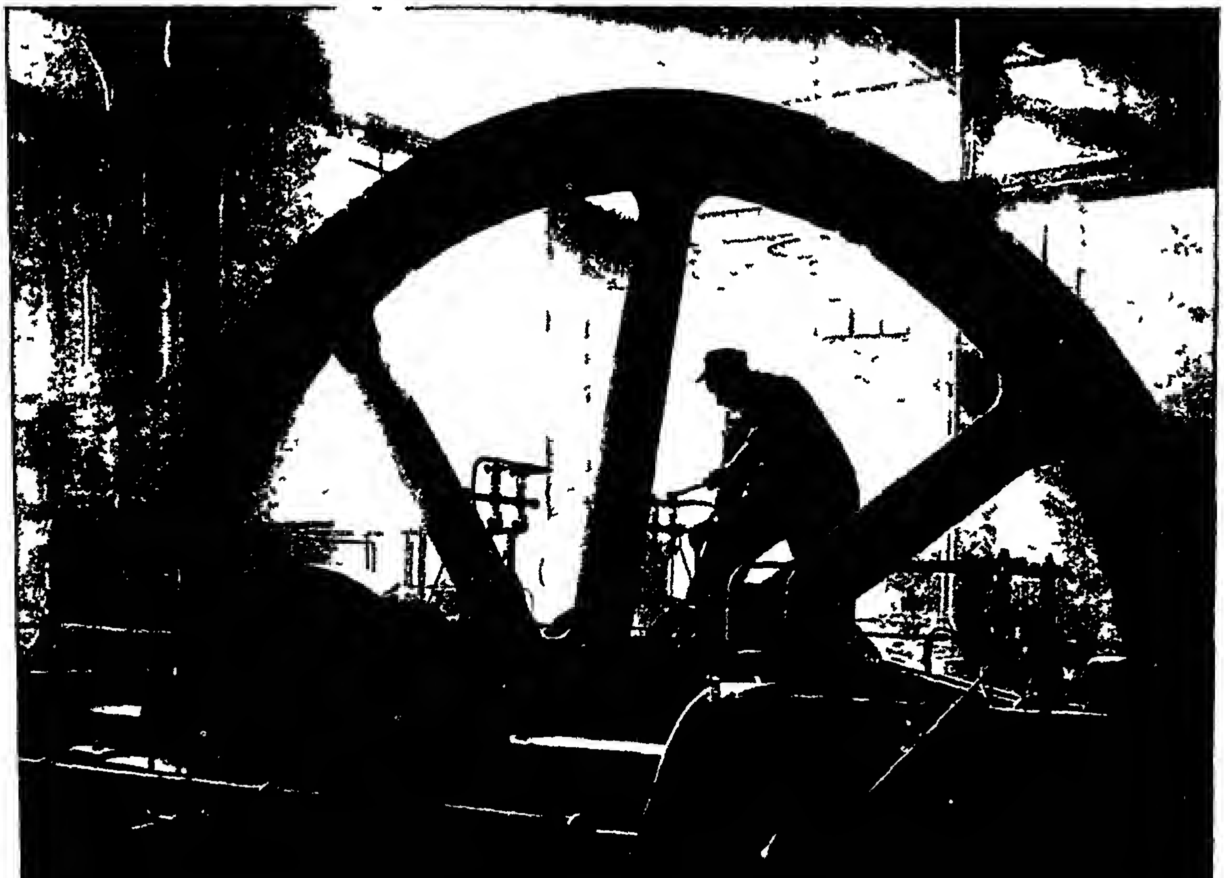
The first machine-guns were fired by turning a crank by hand, but the newer models are automatic or semi-automatic The automatic types may be divided into those in which the gun is operated by the recoil of shot, and those in which the gun is worked by waste gases of the explosion The rate of fire of machine-guns depends upon the gun, and varies from 60 or 75 to 600 rounds a minute

The first practical machine gun was invented by an American, Dr R J Gatling (1818–1903), in 1861 It consisted of ten parallel barrels, and could fire 500 shots a minute

The Maxim gun was the first of the automatic type It was invented about 1881 by Sir Hiram Maxim (1840-1916) and is water cooled As the Vickers Maxim gun it was used by British soldiers in the War of 1914 18 and was the official weapon of other countries, its descendant, the "Vickers" gun is still used

The Lewis gun was invented by Colonel Isaac Newton Lewis (1858–1931) He was an American, but when his gun was rejected by the U S army, it was adopted in France, Belgium, and Britain, remaining until 1935 the standard light machine-gun of the British army It fires about 550 rounds per minute, but is inclined to jam, the gun is worked by the pressure of the gases from fired cartridges After 1935, however, a new, lighter, and more reliable gun, the Czechoslovakian Bren, began to be issued to the British army Of the same bore as the Lewis (303), it can be used on a tripod (resting the butt on the shoulder) or on a separate tripod, and under certain circumstances can even be fired from the shoulder This gun is air-cooled, possessing two barrels that can be changed in under half a minute

Machinery. Machines are Man's answer to the ever-present problem of securing greater results in the time allotted for a task They are something more than tools, by which Man supplements the power of his hands In the



WHICH IS THE MASTER—THE MAN OR THE MACHINE?

This picture symbolizes one of the problems that the Machine Age has created Man masters the world with his machines, but the machines in turn tend to become the masters of men Thousands of workers can earn their living only with these monsters of steel as their daily partners The machines speed up, slow down, or stop altogether according to the unpredictable demands of trade, and the men who serve the machines must adapt their lives to these blind shifts and uncertainties

physical sense, most tools are simple machines, for they enable a man to produce more work with less energy But, practically speaking, a machine performs repeatedly a complicated and more or less complete task at an actual saving of time and labour

Modern business is an expression of the wealth-creating power of machinery, and it is equally at the mercy of machine development Science, working hand in hand with business, has devised methods of utilizing the natural resources of the world through machinery, with the result that mere man-power and animal-power have been almost supplanted by energy produced from water, coal, and oil With the almost unlimited energy thus available, business has been able to embark on programmes of mass production impossible with hand methods

Machines Instead of Men?

It has been asserted that machines thus supplant the labour of men The defence is that more men are required to manufacture the machines themselves, to supply them with raw materials, and to transport and market the ever-increasing stream of finished products poured forth from more and more machines Machines tend to lower costs with a consequent reduction of prices, which in itself widens the market and increases demand

It can be charged to machinery, however, that it shifts employment, and its introduction may tend to upset conditions of employment for a time, until workers have been placed elsewhere in the complex organization involved in production, distribution, and sale In the long run, however, the position tends to stabilize itself, because the invention and use of new mechanism often creates an entirely new industry and widens the scope for employment in older industries

Mass production by machinery has been blamed for periods of economic depression, but it may be that men have failed to take advantage of the leisure to which the machine entitles them, and by working too long hours are encroaching upon the status of other workers

The very name first applied to machines—engines—signified something that produced within itself There were engines of war, such as the "ballistae" (catapults) which could cast stones further than men could hurl them, rams which could batter down walls otherwise impregnable, and peace-time applications of these and other basic mechanical principles When steam was discovered as a source of power, the term engine came to be used only to signify machines capable of developing power by steam With the advent of the internal combustion engine, the word has been extended to include all prime movers, or machines that transform energy into power The term engine is also applied to machines which produce fine divisions or calibrations on scales, precision tools, and scientific instruments, and we also have the term "engine turning," applied to the production of intricate designs on watch cases and on plates for printing currency notes and securities In the modern sense, a machine differs from a tool in being more complex and repeating its operations over and over again

The motor-car is a splendid example of the modern machine, for it is the product of scores of specially designed machines and of processes that came into existence for the sole purpose of helping in the production of motor-cars A high degree of precision has been developed, particularly in the finishing of parts, both to reduce the wear and to make it possible to assemble and replace parts that will fit accurately without hand work But, nevertheless, skilled help to operate machines is still a necessity, despite a constant tendency to combine various operations and processes into one machine handling

Mackenzie, RIVER The greatest river of Canada, the Mackenzie flows nearly 2,500 miles from its source in the Rocky Mountains to the Arctic Ocean It drains an area which is 100,000 square miles larger than the basin of the Great Lakes and the St Lawrence In its course it gathers the waters of three immense lakes—Lake Athabaska, Great Slave Lake, and Great Bear Lake Great Bear Lake lies so far north that its surface is frozen for nine months

From its source to Lake Athabaska, this mighty river is known as the river Athabaska, thence to Great Slave Lake, as the Slave river, and from there to its mouth as the Mackenzie river In summer, steamboats of the Hudson's Bay Company ply from Great Slave Lake almost to the river's mouth, where it spreads into many branches flowing through a wide, flat delta The Athabaska and its other great tributaries, the Peace and the Liard, are navigable much of their length for steamboats of shallow draught

The Mackenzie river was named after Sir Alexander Mackenzie (1764–1820), a fur-trader and explorer, who discovered it

Mackerel. Next to cod and herring, the mackerel are the most important food fish of the North Atlantic The various species of mackerel cover a wide range and are found in shoals, sometimes of immense size, in nearly all tropical and temperate seas They lay eggs in the open sea, but migrate periodically towards the shore in pursuit of shoals of herring and their fry, which form their principal food When herrings are scarce they live on small crustaceans

The common mackerel of the North Atlantic (*Scomber scombrus*) is usually from fourteen to sixteen inches long and weighs about 2 lb It sometimes attains a much larger size, but the smaller fish are considered better for the table Its regular, rather narrow form, blue colour with

darker, shimmering bands, and fierce and greedy disposition make it typical of the family. These characteristics are exaggerated in the larger members of this family, such as the albacore, bonito, and tunny. The horse mackerel, or scad (*Caranx trachurus*), is no relation of these fish at all.

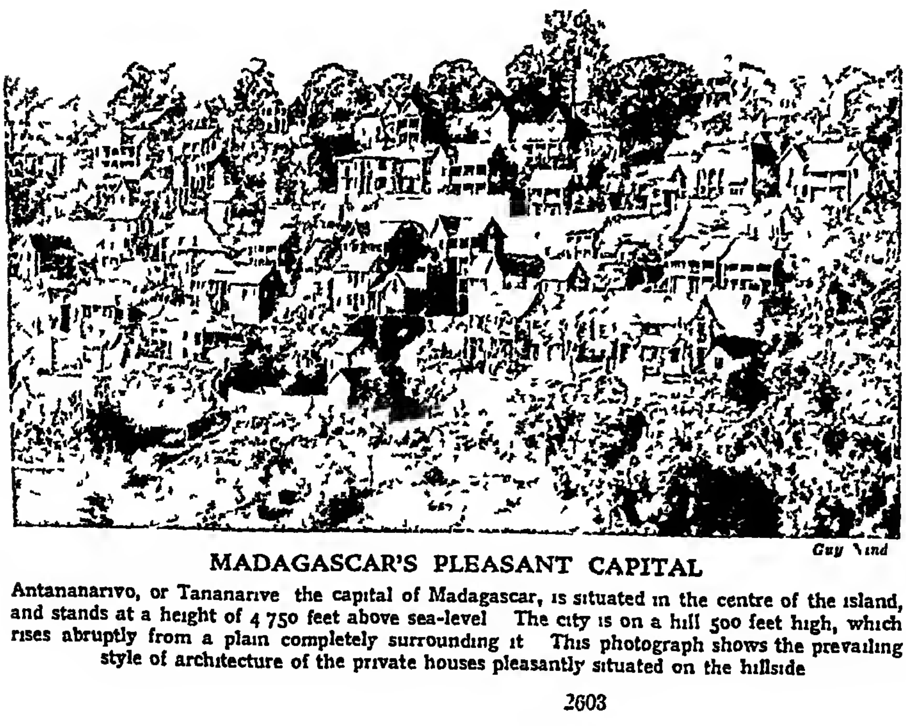
In Norway and around the British Isles, mackerel fishing is a most important industry. In Europe small boats and hand-lines are used almost exclusively, but in America purse-seines are employed. (*See* Fisheries.) The fishing begins in March or April. Simple mackerel fishing, however, is probably the first sea fishing you will ever do from a boat. You have but to row or, better, to sail over the area where the fish are, trailing a hand-line. For bait you use an artificial, bright metal spinner, or a slip of silvery skin cut from a mackerel already caught. A sharp tug shows when a fish is biting—so greedily as usually to hook itself, and in a shoal you haul them out as fast as you can rebait your line. Sometimes even they will rush at the bare, silvery hook and actually catch themselves! (*See also* Tunny.)


Schensky

A SMALL SHOAL OF MACKEREL

The mackerel is one of the most handsome of all sea-fish, for its silvery sides are striped with dark, shining blue, in much the same pattern as we see, among animals, in the zebra. The clean, smooth outline, small fins and sharply-cleft tail are other features which make this a handsome fish; and it is exceedingly good to eat, too.

Madagas'car. In a far-away island of the South Indian Ocean, 240 miles from the Mozambique coast of Africa, live a tall, graceful, intelligent brown people who call themselves "Malagasy." Their land is Madagascar, one of the largest islands in the world, 980 miles long, 360 miles wide, and 241,000 square miles in area. Since 1896, after its conquest by General Gallieni, Madagascar has been a French colony, and for eighty years before that it had been a sphere of both French and British influence. Some of the talkative, soft-spoken, and amiable Malagasy wear European clothes, but the workaday costume of the natives is still a loincloth over which is draped a long rectangle of cloth that makes the wearer look like an ancient Roman. This cloth is woven by the women folk (who are more intelligent and more industrious than their men) from the fibres of the useful traveller's-tree

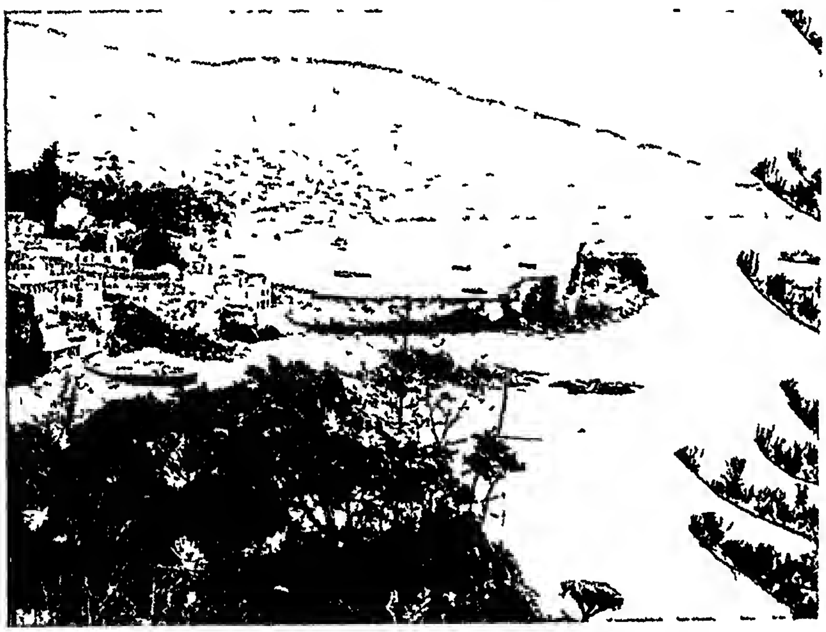

Guy Vind

MADAGASCAR'S PLEASANT CAPITAL

Antananarivo, or Tananarive, the capital of Madagascar, is situated in the centre of the island, and stands at a height of 4,750 feet above sea-level. The city is on a hill 500 feet high, which rises abruptly from a plain completely surrounding it. This photograph shows the prevailing style of architecture of the private houses pleasantly situated on the hillside.

Larger than France, Madagascar has a population (including that of the Mayotta and Comoro islands) of about 3,772,000 It is ruled, under a French Governor-General and a Council of Administration, from Antananarivo (population 98,000), in the heart of its great semi-arid central plateau This has always been the land of its ruling tribe, the Hovas, who are of Malayan descent and live in houses built of wood or brick, or of the red native soil

Among the natives the old pagan beliefs and lax morality, are curiously mixed with professions of Christianity Strange as it may appear, the native beliefs and customs seem to have come from the far-away Malayan islands, and not from Africa, which is much nearer The reason for this is, no doubt, that the African natives are not expert sailors, while the Malays are perhaps the hardiest sailors in the world, and travel thousands of miles in frail craft



CAPITAL OF SUNNY MADEIRA

Funchal, the capital of Madeira, which is now a winter holiday resort, stands in a magnificent situation on the lower slopes of the mountains overlooking the Bay of Funchal The bay forms the fine natural harbour, seen in the photograph, and even large ships can come close in shore In the foreground a rock crowned by a castle rises in the roadstead

Many of the native animals are different from those of the neighbouring continent of Africa They are more like the Asiatic or Malayan animals, and indicate a time when the bed of the Indian Ocean was a connecting land

Agriculture is the chief employment Rice, cattle, rubber, honey, wax, raffia, and straw for hats are the leading products Madagascar's mineral wealth, especially in iron ores, is considerable Gold is exported Its principal port, Tamatave, on the east coast, carries on an extensive trade with France and Great Britain

Madeira. (Pron *ma-dēr'-a*) The traveller who approaches the Madeiras, a small group of rocky islands belonging to Portugal, 360 miles off the north-west coast of Africa, gets his most picturesque impression when his steamer enters Funchal, the chief port and the capital of the island which gives its name to the group

Natives—chiefly of Portuguese descent with some Moorish or negro intermixture—noisy, dark-skinned, and intensely good-humoured fellows, some wearing the "carapuça" a small blue funnel-shaped cap, surround the vessel Their small boats are filled with wares such as cane chairs, basket work, red bananas, pineapples, custard-apples, pomegranates, and other tropical fruits, and sometimes beautiful lace and embroidery Others, swarthy and half-naked, plunge from their canoes into the water after the coins tossed them by the passengers Within the city one sees, among other strange sights, wooden sledges and cars on runners drawn by bullocks, for in the Madeiras wheeled carriages are rare

Madeira itself is a rocky island of volcanic origin, 35 miles long and 12 miles wide, with a few scant forests, deep narrow ravines, and lofty rugged peaks (4,000 to 6,000 feet high) often covered with snow Bold precipices rise abruptly from the coast, and in parts the scenery is wild and beautiful The climate is mild and uniform, and the island is noted as a health resort, especially for persons suffering from diseases of the chest The absence of rain during the summer, and the rocky, hilly, volcanic nature of the land, have made cultivation difficult

The two staple products are sugar and the Madeira wine that is world-famous Vegetables and a variety of fruits are grown—apples, pears, and peaches of poor quality, oranges, lemons, grapes, figs, bananas, and pineapples, the last two forming articles of export

Besides the island of Madeira, one other of the group, Porto Santo, is inhabited Madeira is today a port of call for steamers between Europe and South Africa It is also an important air and cable station Area, 314 square miles, population, 212 000 Funchal, the capital, has a population of some 32,000 inhabitants, other towns are Ponta do Sol and Machico

Madonna. The Italian word Madonna ("my lady") is used for a picture or statue of Mary, the mother of Jesus, and sometimes for the Virgin herself After the 4th century the special homage rendered to the mother of Christ

THE WORLD-FAMOUS 'MADONNA OF THE CHAIR'

Raphael's masterpiece, now hanging in the Pitti Gallery in Florence, owes its origin to a curious incident. For years Raphael had searched for a fitting model, but did not find her until one day he encountered a peasant woman seated and holding a boy in her lap, while another stood nearby. She was exactly the type he had been seeking. Raphael had a pencil, but nothing else, so he seized a smooth barrel head and made his sketch upon its round surface. From this sketch he worked out what has since been called "the most popular painting ever made."

assumed a large place in the minds of the great mass of the common people, for, when the Council of Nicaea in 325 had clearly fixed the place of the Son in the Trinity, He seemed less of an intercessor and more one with God Himself

What more natural than that His mother, in whom all early Christians might also honour womanhood, should be a refuge of the faithful, who might pray to her, and thus gain her powerful intercession with her Son, God the Son The Church in its beliefs and doctrines could not remain untouched by this, and the Virgin Mary assumed a larger and larger place in daily worship in the succeeding centuries So, also, she became the favourite theme of Christian art, from its simple beginnings to its glories in the Renaissance Such quaint stiff little figures they painted of her in the early days! Often her arms were extended in prayer, and she always wore a blue robe starred or slashed with gold which was draped over her head

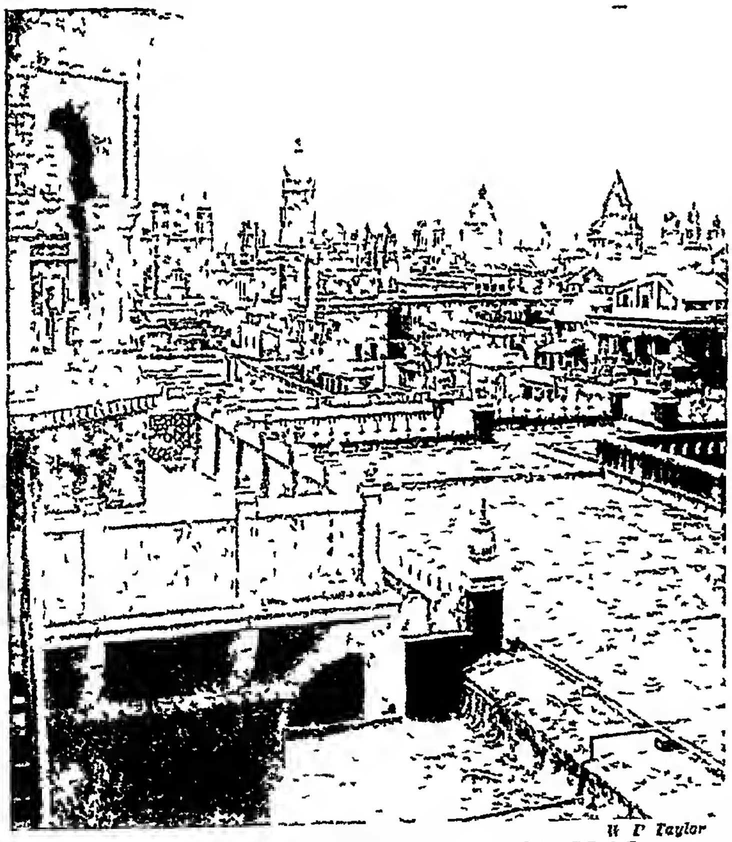
The Madonna became much more natural and beautiful when Italian artists in the 13th century broke away from the old Byzantine types Then Fra Filippo Lippi—discarding even the gold backgrounds that were then so popular—painted some charmingly life-like pictures of the Mother and Child, and thereafter there was scarcely a single Italian master who did not paint one or two such pictures

All the earthly and heavenly scenes of the life of "my lady" were painted, though, of course, with little respect for time or place, so that the Madonnas of any one period usually wear the clothes of that period Moreover, these pictures were painted with the deliberate purpose of illustrating and explaining their relation to the common people themselves Andrea del Sarto's "Madonna of the Sack," Leonardo da Vinci's "Madonna of the Rocks," Titian's glorious "Assumption," Correggio's sweet and tender "Holy Night," Murillo's vision of the "Immaculate Conception"—how wonderful are these Madonna masterpieces!

But though striking and beautiful Madonnas have been lovingly painted by artists of all lands, there is one painter whose work in this field is supreme "Oh, their Raphael of the dear Madonnas!" wrote Browning, thinking of the many celebrated Madonnas painted by the Italian master Raphael's two most famous paintings are that perfect mother picture "The Madonna of the Chair" (see illus in p 2605) and the glorious painting of the Madonna descending from the heights of Heaven, clasping her little Son, while below St Sixtus and St Barbara kneel in adoration—the world's favourite "Sistine Madonna" It is set apart in a room by itself in the gallery at Dresden Another Raphael Madonna is illustrated in page 2289

Madras, (Pron *ma*-drahs'), India Occupying the most southerly part of the great peninsula of India lies Madras, the oldest of the three Presidencies into which India is subdivided—Madras, Bengal, and Bombay To the north lies Hyderabad, the Nizam's dominion, to the north-west the Bombay Presidency, and to the west the state of Mysore Its eastern shores, the Coromandel coast, are washed by the waters of the Bay of Bengal, its western, the Malabar coast, by the Arabian sea Divided from it by the narrow, shallow Palk Strait on the south lies the island of Ceylon The sea breezes help to temper the extreme heat

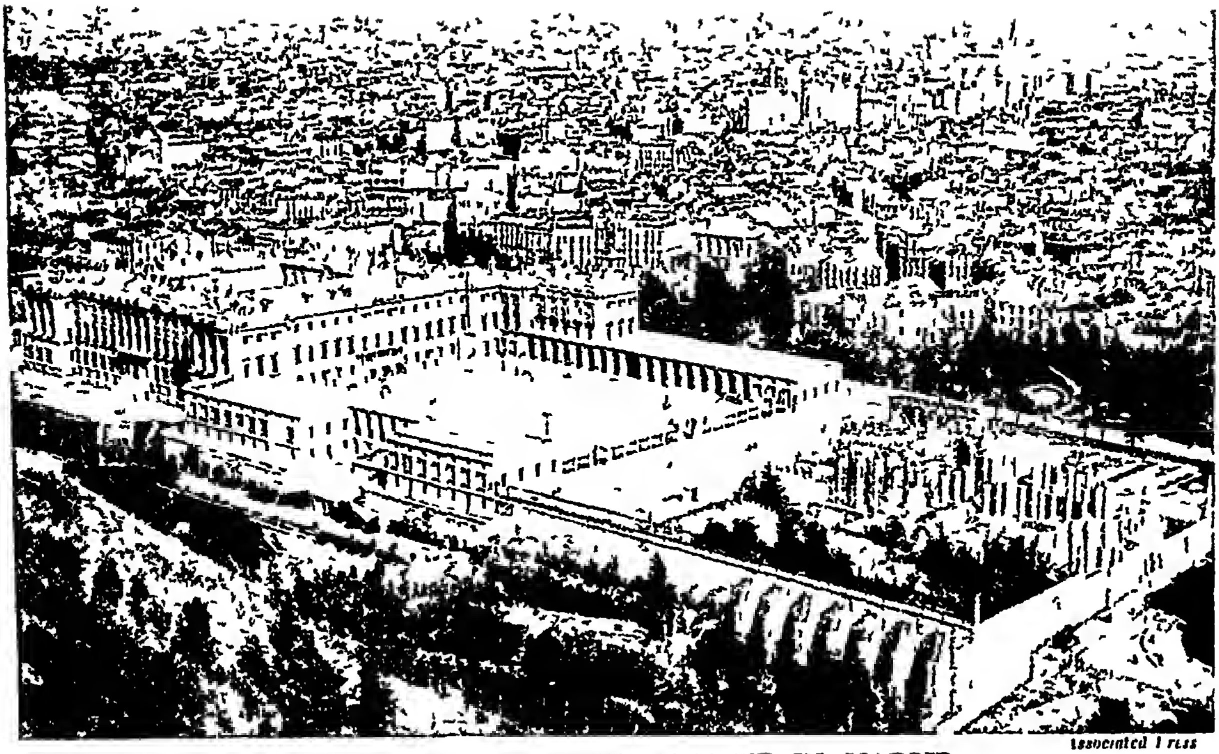
Madras is India as you have always pictured it, the India of toddy palms, rice-stalks standing in water, and Tamil natives naked above the loins, sharp-featured and quick-eyed, with heads close-cropped before and streaming with ragged locks behind The produce is tropical—tea, tobacco, oil-seeds, hides, etc The Kolar and Golconda mines are famous gold centres The generally flat surface is relieved by



W F Taylor

TOWERS AND PINNACLES OF MADRAS

This photograph shows the sky-line of the city of Madras, broken by towers and minarets The highest tower seen in this photograph is that of the High Court which, besides being ornamental, serves a useful purpose, for it is used as a lighthouse It is 160 feet high, and the light can be seen for as great a distance as 20 miles out at sea


Associated Press

WHERE SPAIN'S SOVEREIGNS LIVED IN MADRID

This huge building was formerly the Palacio Real, or Royal Palace, of Madrid, but since Spain became a republic after King Alfonso XIII left the throne in 1931 it has been called the Palacio Nacional. It is built of granite and limestone and was completed, after thirty years work, in 1764. The State Apartments are of great magnificence, and in the armoury seen on the left of the courtyard is the finest collection of armour in the world. This photograph was taken from an aeroplane above the palace grounds before the Civil War broke out in 1936

the Eastern and Western Ghats, which form a rampart to the Deccan, and the Nilgiri Hills.

The capital of the Presidency and its chief seaport is the city of Madras, the third city of India, founded by the British nearly 300 years ago as Fort St George.

With its many trees Madras city is a dense green, rolling away to the south and inland until it is lost in the paler hues of the fields. Many imposing government and college buildings and the original settlement are in this quarter. With several missionary institutions, a university, a college, and schools of art and the professions, Madras is educationally the first city of India. Throughout the whole Presidency English is spoken by all classes.

The weaving of cotton on hand looms is still an important industry in and near Madras. The popular cloth we know as "madras" was first made in a village not far away. Today there are many modern jute mills, under British management, which give employment to large numbers of natives. The water-borne trade of Madras, in small coasting steamers and across the Bay of Bengal to Rangoon, is very important, and has made necessary the construction of a harbour at great expense. The shore is shallow and there is no natural defence against the terrible monsoon storms, and so shipping has to be protected in a harbour of 200 acres surrounded almost entirely by breakwaters.

Teak, sandalwood, rice, sorghum, coffee, and iron and manganese ores are exported in considerable quantities.

The population of the city of Madras is about 647,000; area of Presidency, 142,277 square miles; population, 46,748,000.

Other towns in the Presidency are Madura (182,000), with its famous temple of Siva, Trichinopoly (142,800), and Salem (102,000).

Madrid', SPAIN. When Philip II made Madrid his capital and "only court," in 1560, he chose what was then an unimportant town chiefly because of its central position and, perhaps, because his father Charles V had found its bracing climate healthy. Foreign visitors, however, coming from the pleasant south of Spain to a city lying on a plateau 2,140 feet above the sea—unprotected from the sun in summer or the icy winds that blow from snow-clad peaks in winter, without countryside and without suburbs—may be tempted to think that "the king who never smiled" chose it mainly for its dreariness.

And when they are taken out to Philip's summer palace, the Escorial, 27 miles away to

the north-west, their opinion is confirmed This, as its name indicates, stands on the "cinders" of an old iron mine It is a monastery, a church, and the burying-place of the Spanish kings, as well as a palace Its unusual shape has led to the fanciful explanation that it is fashioned on the lines of the gridiron on which St Lawrence was martyred, the courts representing the interstices of the bars, the towers at the corners the legs, and the palace itself the handle

Although Madrid, which is believed to date from Roman times, was a Moorish outpost in the 10th century and had some 30,000 people at the time Philip made it his capital, it has not the historic picturesqueness of other Spanish cities in whose building the Moors played a principal part

This city represents the new Spain rather than the old, with its wide streets and boulevards, its well-built houses and public buildings, and the splendid bridges that span the meagre trickle of the river Manzanares It is a standing pleasantry with the Spaniards themselves that these bridges should be sold and the proceeds spent to buy water for the river

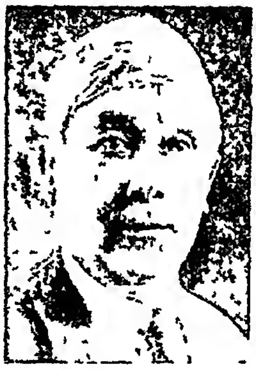
The city centres about the plaza or open space where the Gate of the Sun (*Puerta del Sol*) stood in medieval days About this are hotels, cafes, and government buildings, and from it radiate ten important streets, including the Calle Mayor and the Calle de Alcala A little further north is the Gran Via, a great thoroughfare cut through the heart of Madrid during the World War The fashionable season for Madrid under the monarchy and first republic was when the "Cortes,' or national legislature, was in session

The city is also the chief educational centre of Spain, with its famous old university The new University City on the outskirts of Madrid has been the scene of some of the most bitter fighting in the Civil War Madrid also possesses in the Prado (near the Retiro park) the greatest picture gallery in the world, with the exception of the Louvre in Paris Besides having the most important collection of paintings by the Spanish masters Velazquez and Goya, the Prado contains Raphaels, Titians, and Tintorettos that are rivalled only in Italy, also works by Van Dyck, Rubens, Teniers, and other Flemish painters scarcely to be equalled elsewhere Most of these art treasures were moved to Valencia as a precaution during the Civil War

The former Royal Palace, now the Palacio Nacional, has adjoining it on the south the Armeria, housing probably the world's finest collection of armour

Madrid is the railway centre of Spain, and its industries, though still comparatively unimportant, have developed greatly since 1890 Manufactures of leather, tobacco, chocolate, shoes, furniture, carpets, glassware, and many other products constantly increased During the Civil War which began in 1936, Madrid was the headquarters of the government forces, and had to undergo continual bombardment and siege from the Nationalist forces The population of the city is about 1,014,000

Maeterlinck, MAURICE (Pron mah'-ter-lingk) ¶ (Born 1862) There are some people who think that the world is made solely for Man's use and pleasure, but the Belgian playwright and essayist, Maurice Maeterlinck, sees a soul in all things He has just as many wise thoughts to impart when he watches his bees, flowers, and dogs as he has when he tells the story of a wicked king



MAETERLINCK

Maurice Maeterlinck's play, "The Blue Bird," achieved a world-wide popularity

Maeterlinck's life, for the most part, has been calm and uneventful, and spent in quiet places He was born in Ghent, Belgium, and was educated for the law He became interested while at college in the newer French verse through his acquaintance with Verhaeren, the distinguished Belgian poet Six months in Paris among the younger literary men then turned Maeterlinck's thoughts for ever from the law

In 1889 he published his first play, "La Princesse Maleine" It has an air of sweet unreality, the characters speak simply and repeat their speeches again and again The critics at first made fun of the work—that is, most of them, though some hailed Maeterlinck as "the Belgian Shakespeare"

Maeterlinck went on writing in spite of ridicule Soon people began to see that these plays, which at first some thought so childishly simple, had an elusive beauty of their own, and were full of subtle suggestions of deeper meaning

He is a man of deep thoughts, which he seeks to embody in his plays These thoughts are not rules for men to live by, or laws for the world to follow, but fleeting ideas, hopes, beliefs which come unbidden to people, and yet come so clearly that they cannot but trust them

These thoughts Maeterlinck expresses clearly and directly in his books of essays "The Treasure of the Humble' (1896) is the simplest of all of these In his gentle quiet way he pleads for tolerance for all beings

Amongst his other works may be mentioned "Les Aveugles" (The Blind), 1890, "Monna Vanna," 1903, "L'Oiseau bleu" (The Blue Bird), 1909, "La Vie des Abeilles" (The Life of the Bees), 1901, "La Vie des Fourmis" (The Life of the Ants), 1926

STORY *of the* BLUEBIRD

IT WAS the happiest evening in the year! You know what *that* is. Christmas Eve! Tyltyl and his little sister Mytyl should have been fast asleep. Mummy Tyl had tucked them into their beds and turned out the lamp. But the rich children who lived in the Big House across the way were having a party. Gay music could be heard, and a thin line of light shone in round the wooden shutters which closed the windows.

Tyltyl and Mytyl jumped out of bed. They climbed on a stool and opened a shutter to see. There was a sparkling Christmas tree. Little boys and girls dressed like fairy princes and princesses were dancing around it. A big table was loaded with pink and white candies, creams, and iced cakes.

"Oh, how lovely! Oh, how lovely!" cried dear little Mytyl, clapping her hands with delight. Tyltyl and Mytyl were children of Daddy Tyl, a poor woodcutter. They had not been invited to the party, but they were not envious. It made them happy just to look and listen. They danced merrily around their small, dark room and pretended that they had some of the iced cakes to eat.

A sudden knocking at the door made them jump. Before they could run to open it the latch was lifted. The funniest little old woman, in a bright green dress and red cap, hurried in. She was bent nearly double and leaned on a cane. Her nose and chin almost met over her puckered mouth. Bright mouse-like eyes peered from under her shaggy brows. She might be a witch or a cross old fairy.

"Have you the Bird that is Blue?" she asked impatiently. "My little girl is sick. Nothing will make her well but the Blue Bird."

Now Tyltyl had a turtle dove in a cage, but he wouldn't part with his pet for anything. Besides it was grey.

Tyltyl and the Wonderworking Diamond

"Well, then, you'll have to go in search of the Blue Bird," said the funny little old woman. She gave Tyltyl a bright green hat, with a magic diamond button on it. "Turn the diamond," she ordered.

Tyltyl put on the hat and turned the diamond. Instantly the poor little dark room grew big and bright and splendid.

"Oh how lovely!" cried dear little Mytyl.

"It's just the same as it always was, only you couldn't really see it," said the fairy, for the funny little woman had turned into the beautiful Fairy Berylune.

Then the clock door flew open and all the laughing hours danced out. The crusty brown soul of Mummy Tyl's good bread hopped from the pan. The soul of sugar appeared as a polite gentleman who broke off his candy fingers and handed them to the children, the soul of milk as a pale maiden. Water was a dripping green lady, fire a flame-coloured hot-tempered man. Light, a dazzling rainbow sort of angel lady, streamed from the lamp. Last of all, Tylette the Cat found his soul and turned into a very polite but rather critical and unfriendly person with a cat face. And Tylo the Dog became a noisy loving dog-boy. He nearly went out of his wits with happiness when he could speak to his little master.

"My little god, I love you, I love you, I love you!" he cried.

The fairy Berylune smiled at the surprised and delighted children. "Now you see all the good things in your home as they really are. But hurry! You must find the Blue Bird before morning. We can go out by the door or the window, just as you please."

Off to Hunt for the Blue Bird!

It was much more exciting to whisk out through the window. In a moment they were off, through the white and frosty air of Christmas Eve, to the palace of the Fairy Berylune. There they were dressed like fairies, or like people and animals in story books. Tylette the Cat was dressed as Puss in Boots.

Everybody but Tylette the Cat wanted the children to find the Blue Bird. When they were going through the forest he called the trees and animals together.

"If Tyltyl and Mytyl find the Blue Bird, then men will know all our secrets. They will have power over us, and take away our liberty. Let us kill the children," he advised.

"No!" snapped Tylo the Dog. "I will guard my

master and his good little sister with my life"

"And I will guard them, too," said Light "While I shine around them danger cannot come near"

So Light and Tylo the Dog went everywhere with Tyltyl and Mytyl They had many adventures, but nothing harmed them The Fairy Berylune thought the Blue Bird might be in the Land of Memory The children went there, and whom do you think they found? Why, their grandfather and grandmother, Gaffer Tyl and Granny Tyl, and seven little brothers and sisters who had died and gone to heaven

They weren't changed at all! They were all fast asleep by the door of a dear little brown cottage, but they woke up at once "We just went to sleep, but we always wake up when our loved ones on earth think of us, and have a fine time with them," said Granny Tyl

But this Blue Bird Turned Black!

They had a lovely time, talking and playing and laughing, and eating the good old-fashioned dinner that Granny Tyl cooked They were all so happy that the black bird which Gaffer Tyl had in a cage turned blue He gave it to Tyltyl and the children hurried away with it to the Fairy Berylune But when they had left the misty Land of Memory behind the bird turned black again

"The children went to the Land of Memory, and whom do you think they found? Why, their grandfather and grandmother, Gaffer Tyl and Granny Tyl, and seven little brothers and sisters who had died and gone to heaven They were all fast asleep by the door of a dear little brown cottage, but they woke up at once"

Light was sure that the Blue Bird was hidden in the dreadful Palace of Night Tylette the Cat overheard her He was a great friend of Night and knew all her dark secrets So he went on ahead and warned Night that the children were coming Night tried to frighten them with stories of the Fears and Terrors, Diseases, Troubles, and Ghosts that lived behind great doors in her dark caverns

But Tyltyl was a brave boy, and Tylo the Dog was brave, and Light stood outside waiting for them, for she was not allowed to enter the Palace of Night One after another, Tyltyl opened the doors, peeped in, and clapped them shut again The last and biggest door of all he pushed wide For the vast cavern was flooded with moonlight and filled with birds of the Moon There were millions of them, as blue as the sky!

The real Blue Bird, who could live in the sunlight, was there, perched high on a ray of light But how was Tyltyl to know that, when it looked just like the others? He gathered his arms full of birds and they all hurried away through the brightening dawn to the Fairy Berylune When the first ray of the morning sun struck the blue birds they turned grey and died

Tyltyl and Mytyl were so disappointed that they nearly cried Then Light happened to think that there must be a Blue Bird in the Land of Unborn Children They found millions of tiny babies waiting to be born Those who were all ready for the journey to the earth, with their little boxes packed with talents, good luck, gold, measles, whooping-cough, sweet tempers, or odds and ends, hurried onto a ship at dawn and sailed away Tyltyl and Mytyl were listening to the sweet singing of the mothers on earth as they came to greet their new babies, when Light flew past

"I have the Blue Bird Turn the diamond Time is after us and we must fly to escape"

And There was the Blue Bird at Home!

In a twinkling they were at home, in the woodcutter's poor little cottage Light was gone, and Fairy Berylune The hours trooped back into the clock The souls of things took their old forms Tylette the Cat curled up on the warm hearth and went to sleep Only the heart of Tylo the Dog was nearly broken because he could never speak to his little master again

"Well, well, sleepy heads, wake up! Merry Christmas!"

THE SEARCH FOR THE WONDERFUL BLUE BIRD

'Light was sure that the Blue Bird was hidden in the dreadful Palace of Night Tylette the Cat was a great friend of Night and knew all her dark secrets So he went ahead and warned Night that the children were coming Night tried to frighten them with stories of the Fears and Terrors, Diseases, Troubles, and Ghosts that lived behind great doors in her caverns But Tyltyl was a brave boy and Tylo the Dog was brave One after another, Tyltyl opened the doors The last and biggest of all he pushed wide The vast cavern was flooded with moonlight and filled with birds of the Moon millions of them as blue as the sky!

Tyltyl and Mytyl sat up in their beds and blinked their eyes Daddy Tyl and Mummy Tyl were laughing at them for being so hard to awaken Tyltyl flung his arms round the neck of Tylo the Dog, who licked his face

"Oh, how lovely!" cried little Mytyl "How nice it is to be home It's so big and bright and beautiful How good the bread and milk and sugar are The water is so cold and clear, and the fire so warm and bright And the clock is full of lovely hours to play with"

The children said and did such queer things and were so wildly happy that Daddy and Mummy Tyl thought they were out of their heads When Madame Berlingot, a funny little old neighbour who was so bent that she walked with a cane, came in, she told them that her little girl was sick

"Fairy Berylune Light has the Blue Bird, but your little girl can have my grey dove," said Tyltyl

"Why, what is the child talking about? I'm not a fairy" But Mytyl chuckled, and Tyltyl took down the cage *The dove had turned blue!*

"Take it! It will make your little girl well!"

In a moment she was back A miracle had happened The little girl was well and strong and happy For a moment the Blue Bird nestled in her arms Then in a flash it was gone

Tyltyl and Mytyl told me to ask you if you ever find the Blue Bird please send it back, for they need it for their happiness But if you did return it they would be sure to give it away again to the first person who asked for it

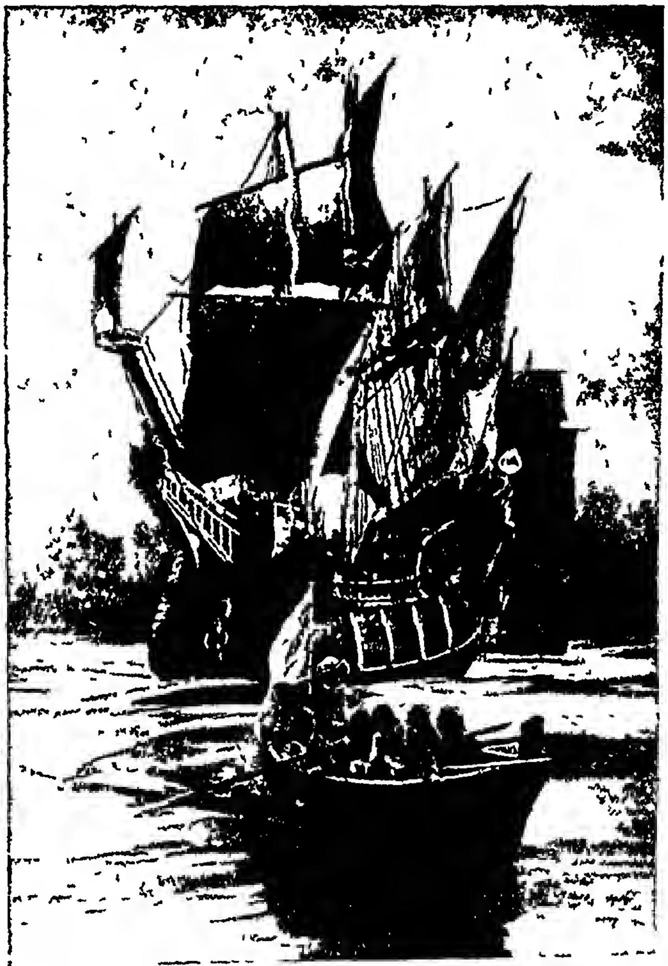
And where do you think you should look for the Blue Bird?

Adapted from the story of "The Blue Bird by Maurice Maeterlinck, by permission of and special arrangement with M Maeterlinck and his publishers, Messrs Methuen & Co Ltd holders of the English copyright

Magel'lan, FERDINAND (FERNÃO DE MAGALHAES) (1480–1521) "The ocean! The great western ocean!" shouted the Spanish seamen, as their cannon saluted the mighty Pacific for which they had been searching many weary months "If we live we shall yet discover the new way to the Spice Islands!"

"Thank God our Lord!" exclaimed Magellan, their captain "It is true, Señores, that we have lost two vessels, that our provisions are wasted, and that we may have many more hardships yet to endure But even if we are reduced to eating the leather on our ships' yards, we will go on!"

This is the dauntless spirit shown by that Portuguese mariner who discovered the Strait of Magellan, and who was not only the first European navigator to sail across the Pacific Ocean, but also the first person to discover a route over which ships could sail in a complete circle round the world



MAGELLAN AND HIS LITTLE ARMADA

The great navigator set out on the voyage which was to end in the circumnavigation of the earth on September 20, 1519, with five ships The Trinidad was his flagship, but it sprang a leak and he transferred to the Vittoria, seen above In this picture Magellan and some of his sailors are taking soundings from a small boat

Magellan, the son of a Portuguese nobleman, early served in the Indies and Morocco with distinction Believing his king had not justly rewarded his services, he renounced his nationality and offered to serve Charles V of Spain This ruler, remembering the discoveries of Columbus and other bold sailors, finally accepted Magellan's proposal that he should make an attempt to reach the Moluccas or Spice Islands by sailing west instead of east, and on August 10, 1519, Magellan set sail from Seville in command of five small vessels Across the Atlantic and down the coast of South America he sailed until very cold and stormy weather forced him to seek winter quarters Here mutiny was put down by force

Magellan was both resolute and ruthless He would brook no interference on the part of any-

THE FEARLESS SAILOR WHO LINKED TWO OCEANS

On September 20, 1519, there set sail from Spain a brave and intrepid navigator This was Fernando de Magellan or Magalhaens, whom the Spanish king, Charles V, had entrusted with a fleet of five ships and 236 sailors so that he might endeavour to discover a westward passage to the Pacific Cape Virgin was reached at the end of October and here was held a council which opposed Magellan s desire to progress farther The fearless explorer, however, pressed forward and sailed through the strait which now bears his name He later reached the Philippines, where he was killed by a native

Painted specially for this work by DUDLEY TENNANT

To face page 2612

'MAGICAL' HATS TO CHARM THE WEATHER

Magic is practised by many very primitive peoples in the full belief that the forces of Nature can be influenced by it These men, belonging to the Baining tribe who live in the interior of the Gazelle Peninsula of New Britain, are engaged in a dance of magic significance The strange hats they wear are made of beaten tree bark and are held in position by long strings of fibre They are supposed to have a magical influence on the weather

body, and although it was made a condition that he should consult his second in command whenever matters of importance arose, he studiously refrained from doing so

Sailing on again in the spring (which comes in September in the Southern Hemisphere), Magellan's fleet rounded a promontory, and on October 21 he sighted what he thought must be the sought-for strait leading to the East

For over a month he battled his way through this stormy 360 mile passage One vessel was wrecked and another stole away and sailed back to Spain, but still Magellan persevered On November 28, 1520, he reached the ocean that Balboa discovered seven years before, and which Magellan now named the Pacific

At first the voyage on the Pacific went well, save for monotony One of the sources of amusement was a Patagonian, whom Magellan had kidnapped with the idea of exhibiting him in Spain when they returned, and the chronicler of the voyage, an Italian named Antonio Pigafetta, even made progress in setting down the Patagonian language

Here is a quaint entry from the observant Pigafetta's diary "There is one kind of bird of such a nature that the female lays her eggs on the back of the male, and there they are hatched This kind have no feet and are always in the sea"

We are also told that "the body of St Elmo appeared to us several times One night, when it was very dark, the saint appeared in the form of a fire, lighted on the main truck, which comforted us greatly, for we were in tears, only expecting the hour of perishing When this light once descends upon a vessel she is never lost" St Elmo's fire, as it is called today, is really a very rare kind of lightning

But after a month of sailing, terrible hardships assailed the fleet The provisions ran low, and rats and leather became choice foods The drinking water turned thick and yellow, and dozens died of scurvy In all, the fleet sailed ninety-three days before discovering Guam of the Ladrones, and a week later the Philippines Magellan established friendly relations with the king of Cebu, who made a profession of Christianity in order to win his help

The great navigator, who was induced to undertake an expedition to conquer the neighbouring island of Mactan for the Catholic faith and the king of Cebu, was killed in a fight with the natives, April 27, 1521 The king of Cebu afterwards got into his power several of the explorer's most prominent men and murdered them The survivors burned one of the three remaining vessels and sailed on to the Moluccas or Spice Islands Another vessel, becoming leaky, had to be abandoned

The last remaining vessel, laden with spices, at last rounded the Cape of Good Hope and in melancholy triumph dropped anchor in the harbour of Seville, September 9, 1522

The MYSTERIOUS REALM *of* MAGIC

Religion, superstition, and magic are all closely interwoven Do you know why you touch wood to avoid ill-luck? Or why you carry a mascot? These are primitive magical practices that linger on in modern times

Magic. Our early ancestor, primitive Man, had more faith in his powers than we have in ours He believed that by doing certain things he could influence the health or behaviour of people at a distance, and even control the forces of Nature themselves by saying certain forms of words or performing certain ceremonial acts He believed, that is to say, in magic This belief has survived in many people down to the present day, and is most strong amongst the least civilized

This blacksmith is puzzled to decide which way is the lucky way to hang the horseshoe!

But in course of time repeated failure brought proof that there were many things—the changes of the seasons, the vagaries of the weather, and the occurrence of diseases and accidents—which were not controllable by human action Hence arose the belief in powers greater than Man's, which must be humoured and propitiated From this belief came the idea of religion and worship (*See* Gods) Put briefly, the difference between magic and religion is that by means of magic Man strives to *compel* the powers of Nature to obey him, whereas in religion he strives to *persuade* the gods to do what he wants by means of prayer or sacrifice

Magic Survives in Superstition

Neither religion nor modern science has been able to kill the belief in magic, which still flourishes in backward races, and has left many traces in the superstitions of educated people

Among the earliest forms of magic are those which rest upon the belief that the fate of an individual may be influenced by getting possession of something which once belonged to him A lock of hair, nail clippings, or a drop of blood

might put the person from whom they came completely in the hands of the magician This is still believed among the natives of the Pacific islands, among the Patagonians of South America, and even in certain peasant districts of Germany A bit of clothing stolen from an enemy was also considered a powerful agent of magic The belief spread to include almost everything which had come in close contact with a man's body Thus, Australian savages drove sharp stones into a man's footprints to make him go lame

On the other hand, the weapons or clothing of a man noted for courage may make a hero of the one who seizes them The claws of a lion will bring the wearer the boldness of the king of beasts, the feathers of the eagle will give swiftness and keenness of eye These beliefs even affect the food of the savages Thus, the flesh of deer or rabbit may create cowardice, but the meat of the lion, the tiger, the bull, give strength Cannibalism was, in part, the outgrowth of such superstitions as these, for savages thought that by eating part of an enemy they could acquire his strength and courage

ONE OF CENTRAL AFRICA'S MEDICINE-MEN

Among primitive people, magicians or medicine-men gain great influence and often rise to be chieftains From this photograph of an African medicine-man we may gather something of the awe that he commands from the whole village as he goes through the ceremony for bringing rain, good crops, success in hunting, or victory in battle

Later came the belief that, by imitating the thing or person that he desired to influence, the magician could establish his control Pretended "rain-makers" almost always sprinkled water, made smoke clouds, used flashes of fire to indicate lightning and wooden clappers to imitate thunder Stones shaped like vegetables were buried in the soil to make real plants grow American Indians drew the picture of an antelope on a piece of bark and shot at it with an arrow If they struck the drawing, it meant that they would be lucky in their hunting It seems very probable that the cave paintings of France and Spain were originally drawn for a similar purpose, for they all represent animals that were hunted, and in many drawings the animals are depicted as being shot with arrows (*See* Cave Dwellers *and* plate facing page 886)

It was the custom among many peoples to make figures of wax or clay resembling the persons they wished to injure Calling them by name, the magicians would thrust pins into the figures or tear off an arm or leg, or melt them in fire or water, whereupon illness and death accompanied by great pain were supposed to come upon the person indicated This practice prevailed in Ireland and England for many centuries It still exists in the voodoo rites of certain negro groups in the southern states of America, being inherited from ancient African beliefs

The power of names forms a branch of almost all magic The name was considered as part of a man, and by pronouncing it under proper circumstances he could be influenced for either good or bad From this belief grew the curious custom among many savage tribes of having two names for each individual—a real name, which was always kept a careful secret, and an everyday title for general use, through which he could never be influenced magically This custom is still prevalent among certain tribes in various parts of the world, but, like many other customs, is not practised nearly so much as it once was

Gods and spirits were believed to have special magic names, known only to a chosen few Uttering these names was supposed to give a man some power over these supernatural beings In this way grew up the spells and

MAGIC-DANCE OF THE AUSTRALIAN ABORIGINES

These grotesque and terrifying figures are "blackfellows" of Queensland They are engaged in the "Dance of the Forked Stick," which is supposed to bring anything the tribe desires greatly, from rain to victory over enemies. During such ceremonies it is not unusual for the dancers to become so frenzied with excitement that they thrust their feet into the fire apparently without feeling it At other times they fall rigid to the ground, and lie unconscious for hours

MAGIC MASKS IN NEW GUINEA

The three strange masks shown here are worn by priests or magicians of the New Guinea head-hunters when placing a tabu on fruit trees The masks probably represent the spirits that are believed to haunt anyone who breaks the tabu

charms which form so large a part in the history of magic

Charm-words or certain secret sentences called incantations were used for summoning the spirits of the dead, and all the various forms of jinn, goblins, and fairies, who would then obey the orders of the one who possessed the secret The belief in "putting spells" on hated rivals or other enemies existed in all countries, and continues among the uneducated today The theory of the curse is part of such a belief

Certain spells, like the Irish *geasa*, compelled the person addressed to carry out any reasonable task which might be demanded, under penalty of losing honour and reputation Other spells, like the *tabu* of the Pacific islands, prohibited certain actions A dwelling might be tabu, in which case no one could enter it under threat of magic punishment Various animals or fish, fruits, and vegetables might become tabu for certain members of a tribe and not for others This tabu power was often used by native chiefs and priests in place of laws, and it was held in such terror that violations were exceedingly rare

The word "charm" is also used to describe talismans, amulets, mascots, and any object which is carried to bring good luck Almost anything may become a charm in this sense Usually the person discovers the magic properties of the object himself, and while it may be a charm for him, it is often supposed to bring bad luck to any other person

The most general use of talismans and amulets is to guard against the "evil eye," the fear of which exists in one form or another in almost all parts of the world Certain persons are believed to have this evil eye and to bring disaster to anything they gaze at, unless proper magic protection is provided A common charm against the evil eye is the figure of a hand, which is often painted on the doors of houses in Palestine to this day A surprising number even of educated people retain a belief in charms of some kind, even if it is only a "lucky penny"

When a charm is believed to be not merely an instrument of magic but the actual dwelling-place of a certain spirit, it is called a "fetish" This belief is very common on the Guinea coast of Africa, and it is from this part that the word "fetish" comes to us The worship of fetishes is usually regarded as a form of religion, but it has many of the characteristics of ordinary magic Fetishism plays a large part in the voodoo practices mentioned above

While most forms of magic are based on the belief that evil spirits are particularly numerous and likely to injure mankind, there arises also a belief in good spirits Along these lines, the practice of magic came to be divided into black magic and white magic—the former being used to do harm, the latter to combat this harm and do good instead

The special magician or sorcerer has existed wherever a belief in magic prevailed Under the name of necromancers, wizards, witches, conjurers, medicine-men, soothsayers, astrologers, and many other titles, they posed as persons who had unusual powers over the spirit world, and could foretell the future or read the secrets of the past They were everywhere regarded by the people with fearful respect In Christian countries persons suspected of dealing with the powers of evil were persecuted severely, and many thousands were put to death

But many of their practices were regarded as beneficial, even in Europe, in the Middle Ages and later. Studies in magic frequently led to important scientific discoveries, for the sorcerers, in contriving their magic philtres and other drugs, made valuable researches in chemistry, while those who studied the influence of the stars on human life learned many a valuable fact about astronomy.

In common practice, however, their so called skill was directed toward interpreting dreams, getting information about the future from their "familiar" spirits, and, in almost all cases, deceiving a superstitious public for their own personal profit. Among the intelligent, their fraud was usually suspected, and the Roman Cato "wondered how one diviner could meet another on the street without laughing."

While modern Man prides himself on having thrown off all such superstitions, remnants of magical belief are found even among fairly intelligent people, and many of these are regarded seriously. Under this head come all the delusions about breaking mirrors, walking under ladders, the number 13, Friday, lucky coins, spilling salt, wish bones, black cats, opals, and a thousand other things that are supposed to bring good luck or bad luck. Medical superstitions too numerous to mention also remain. Any almanac will give a list of zodiac signs which are believed to govern the planting of crops, the treatment of farm animals, and to perform other functions equally magical, even to influencing the character and fate of those born under them. In the "popular" press of today we often see a revival of these age old superstitious beliefs in features given some such heading as "What the stars foretell."

In place of the old magician, we have today the fortune teller, the clairvoyant, the crystal-gazer, and the palmist, while many of the practices of the spiritualistic mediums, and such contrivances as the planchette, are looked upon by most scientists as relics of the magic arts practised by our primitive ancestors.

MAGIC IN ENGLISH FIELDS

Some of the ornaments on these horses were originally charms to ward off "the evil eye." They were introduced when the magic power of witches was greatly feared and had to be frustrated by such means.

Photo F S Manley

Magna Carta. "Why do they not ask for my kingdom? I will never grant such liberties as will make me a slave!" Such was the angry answer of tyrannical King John of England to the first demand of his barons for a charter of reforms.

His tyranny, his wickedness, and his weaknesses had united against him all classes of his kingdom—nobles, churchmen, and townsmen. And while he was waging a losing war on the Continent, seeking to recover his French dominions, the leading barons of England had secretly met together and sworn to compel the king to respect the rights of his subjects, as provided by previous law and custom.

In various ways John sought to break up the forces that confronted him, but even his assumption of the Crusader's cross was in vain. On June 15, in the year 1215, he at last met the nobles "between Staines and Windsor in a meadow which is called Runnymede," on the Thames. Deserted by all but a handful of personal followers, he was forced to affix his seal to the Great Charter—called Magna Carta (or Charta) in Latin, the language in which it was written.

Four copies of the Charter still exist. The most complete is in Lincoln Cathedral, another is in Salisbury Cathedral, and two are to be seen in the British Museum. (*See* illustrations in pages 1516 and 1525)

It is said that when King John granted the Great Charter, he smiled and spoke pleasantly to the lords about him, but that when he reached his own chamber he threw himself on the floor in a mad rage, gnashing his teeth in fury.

Since that day the Charter has repeatedly been confirmed by succeeding kings of England, and has become a part of English law and the foundation of the constitution of every English speaking nation.

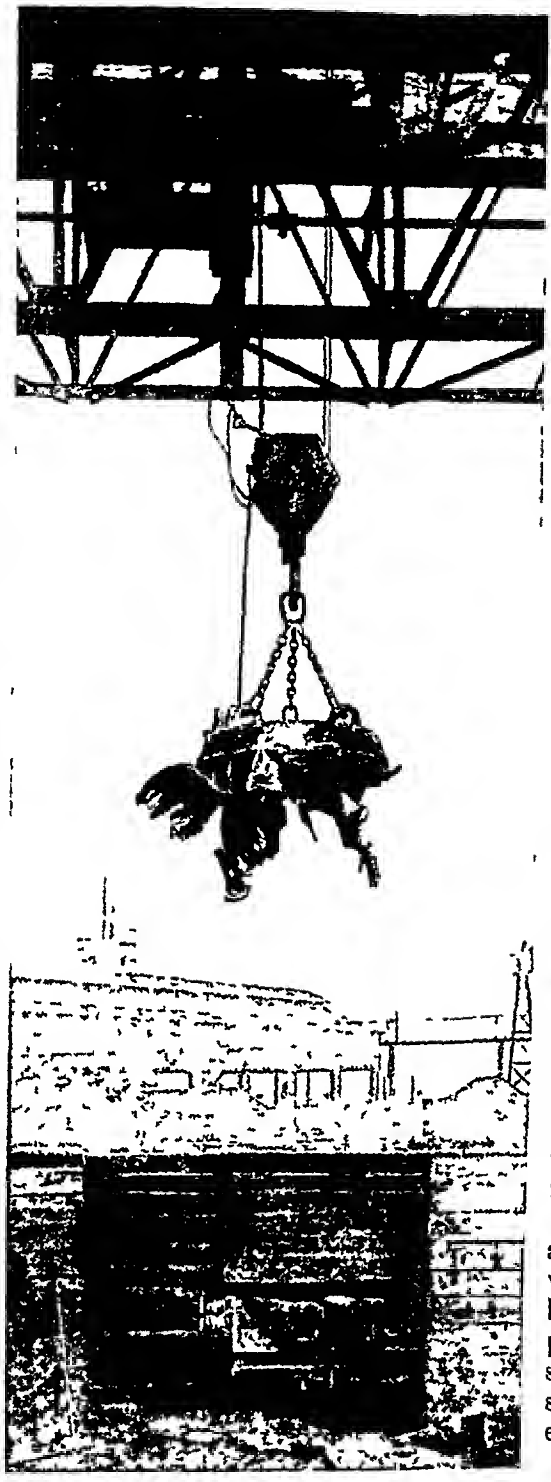
Historical students today agree that the barons were not so unselfish as was once thought. They were chiefly interested in securing their own rights, and they paid little attention to the rights of the common people or the constitutional

liberties of the realm as a whole Thus the Charter, in its sixty-three "chapters" or sections, deals for the most part with feudal rights and duties which became obsolete when feudalism died out Its chief permanent importance is that it established the principle that "the king is below the law" and not above it

In later days new and more liberal meanings were read into some of its provisions, and all classes came to reap the benefits which the barons won for themselves But modern writers find in it no such guarantees of jury trial or right of Parliamentary taxation as were found in the Charter by 17th- and 18th-century legal writers

It provided, among other things, that no free man shall be arrested or detained in prison, or deprived of his freehold, or outlawed or banished, or in any way molested

Magne'sium. Anyone who has been in flashlight pictures knows that flashlight powder, which contains the metal magnesium, burns with an intense white light Magnesium never occurs free, but is present in many minerals, such as asbestos and magnesite, the latter being used in making fire-brick and artificial stone The chloride and sulphate occur in mineral and sea water, the sulphate being better known as the "Epsom Salts" used in medicine The metal was first discovered by Sir Humphry Davy in 1808 For a long time manufacture was on a small scale, but now large quantities are recovered by fusing, washing, and distilling certain compounds, or by passing electricity through certain chemical salts Magnesium has a silver-white colour, which is tarnished by moist air It is very light, but can be hammered, rolled, polished, and filed The carbonates, hydroxide, and other salts of magnesium are of great value to doctors for correcting stomach and digestive disorders



THE MAGNETIC CRANE

This photograph shows a powerful electro-magnet, hung from a gantry crane, picking up scrap iron A heavy steel ball, picked up by the magnet, is allowed to drop on the iron so as to break it up into pieces

Courtesy of G E C Ltd

Magnet. When you visit a big modern steel works, you may see hanging by heavy chains from overhead tracks one of the strangest lifting instruments in the world It is a huge metal disk with a number of short, thick iron rods projecting from the bottom Round each of these rods is wound a heavy layer of insulated wire, and big cables bring a powerful electric current to the machine

If you observe it at work, you may see it suddenly let down upon a pile of pig-iron Nothing moves, it has no teeth or jaws or grappling-hooks but as it is hoisted up again a dozen great pigs of iron are hanging to it The crane carrying the machine now travels along the overhead railway to the furnace platform, and there the pigs drop off as if by magic

This machine is simply a powerful electro-magnet, which, when magnetized, has the same general properties as the small "horse-shoe" magnet which we see for sale in toy shops everywhere

Scrap iron, which is difficult and tedious to handle by hand, is easily and rapidly picked up by the electro-magnet, removed from trucks and placed where wanted A safe weighing seven or eight tons is picked up, and by means of a crane carried from one shop to another In a hundred similar ways the electro-magnet is made to accomplish feats which seem little less than marvellous, and which result in great saving of labour and time

It has been known for many centuries that an iron ore which mineralogists call "loadstone"

or "magnetite" has the remarkable property of attracting iron filings A body which possesses this property is said to be "magnetized," and is called a "magnet" Certain parts of a magnetized body attract iron filings more strongly than do others These are called "magnetic poles"

A piece of iron can be magnetized by rubbing it over a piece of loadstone When magnetized the iron will have a magnetic pole at each end For convenience, these poles are called the north and south poles

Each of these poles will attract iron equally, but when two such magnets are brought together, it will be found that, although the north pole of one will strongly attract the south pole of the other, if two north poles or two south poles are brought together they will repel each other with a corresponding violence

The first profound student of magnetism was Dr William Gilbert (1544–1603), who was a leading scientist in England during the reign of Queen Elizabeth He was led to conclude, from the manner in which small magnets behave at various points on the earth's surface, that the earth itself is a gigantic magnet, with its own poles

The compass used by the mariner, which is a magnet so delicately suspended that it revolves almost without friction, depends entirely on this magnetism of the earth (*See* Compass)

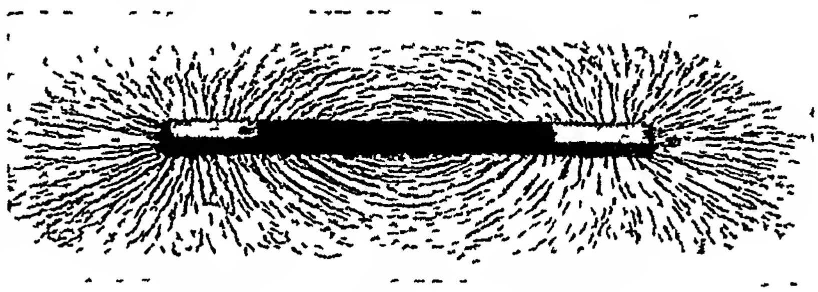
Gilbert showed also that when an iron magnet is heated to red heat, it not only ceases to be magnetized, but loses all ability to become magnetized while it remains hot Red hot iron behaves, therefore, not as cold unmagnetized iron but as cold brass or glass or zinc or any other non magnetic substance This discovery is described by saying that iron loses magnetic quality at red heat

If to the phenomena already described we add that of magnetic induction, we shall have a fairly complete summary of the fundamental facts of magnetism A piece of unmagnetized iron, when brought near a magnet, immediately acquires magnetic poles, *i e*, it exhibits magnetization as well as magnetic quality A wire nail held near a strong magnet not only is itself attracted but acquires the property of attracting other iron nails or iron filings These nails are said to be magnetized by induction

The earth itself will induce magnetism in this way If we take a rod of soft iron and point it north, dipping the end slightly towards the ground, and then give it a few sharp hammer blows on the other end, we find, on bringing it near a delicate compass, that the iron rod has acquired slight magnetic properties

This will help to explain the "molecular theory" of magnetism Iron, like all other kinds of matter, is made up of exceedingly small particles called molecules Each of the iron molecules is regarded as a tiny natural magnet, but in an ordinary piece of iron these tiny magnets are pointing in every possible direction, and so counteract each other This theory is again affected by that of the newer conception of the structure of atoms of which molecules are composed, and by the discoveries of Hertz, Maxwell, Kelvin, and others in the fields of electro-magnetic forces, and the propagation and nature of light waves (*See* Atom)

By placing the iron in line with the direction of magnetic forces of a ready-made magnet like the earth, and by hammering one end of the iron, we jar all the little molecule magnets This gives them a chance to switch round,



LINES OF FORCE ROUND A MAGNET

A bar magnet, like the one in this picture, is always surrounded by a "field of force" which is quite invisible Bring a piece of steel into this "field" and it will try to move along a curved line towards one or the other pole If many little bits of steel, or iron filings, are scattered round the magnet they will tend to set along these lines, thus showing us the direction of the field of force

so that their north poles all point in one direction and their south poles in the other Now that they are all working together the whole iron rod becomes a magnet But as soon as we turn the rod east and west and hammer it again the magnetism disappears Because steel is harder than iron it becomes magnetized much more slowly, but holds its magnetism much longer, for its molecules cannot switch backwards and forwards so easily

The electro magnet, which, as we know, will lift "pigs" of iron, is an instance of magnetic induction by an electric current If electricity flows round a coil of wire inside which there is an iron core, that core becomes a powerful magnet As soon as the current is shut off, however, the magnetic attraction ceases That is why the big lifting machine can first pick up the "pig-iron" and then drop it

Magnolia. The creamy-white blossoms of the "laurel" magnolia (*M grandiflora*), scenting the warm air with their rich, heavy perfume, make this tree a veritable queen of our parks and gardens The large glossy evergreen

'The Times'

GLORY OF THE MAGNOLIAS IN BLOOM AT KEW GARDENS

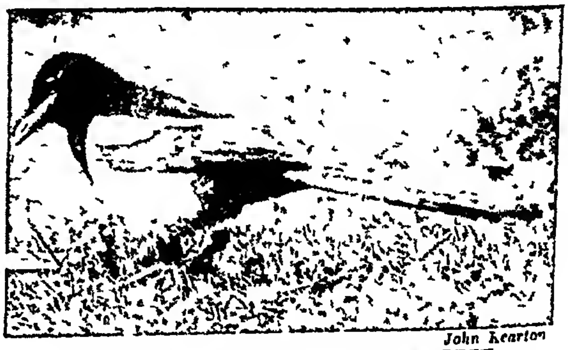
For all their exotic appearance, many species of magnolia are hardy out of doors in Great Britain, and at Kew Gardens they flourish exceedingly, reaching the stature of fair-sized trees and flowering profusely. Here is a photograph, taken in mid-April, when these lovely trees are at their best, and showing a group of them in full bloom. The individual flowers are usually white or pinkish, with large, waxy petals and a cup-like appearance. In the background you can see also numerous spear-shaped buds. These flowers last for some time on the trees before turning brown and dying off

leaves form a fitting setting for the waxy petals and golden cone-shaped heart of the beautiful flowers, which are often 8 to 12 inches in diameter. The flowers are succeeded by cone-like fruits, which are reddish when ripe. In its natural state this tree attains a height of 70 feet, having a straight trunk and spreading limbs. This species has been grown in Britain for over 200 years; another species, which reached us in 1736, is the "cucumber tree," *M. acuminata*, so called from the shape of its fruits.

Altogether there are about 20 species of magnolia, native to the Himalayas, India, and the Far East, as well as to North America. They vary widely in habit and growth, some being evergreen and others deciduous, while the blossoms range from white and light yellow to deep rose and purple. India boasts the finest of all species, *M. campbelli*, a large tree towering to a height of 80 to 150 feet and having a large girth. The flowers vary from white to deep rose.

By very careful selection and cross-breeding additional beautiful varieties have been produced, which flourish in hothouse, garden, and park. The range of some species has been extended, and beautiful specimens may now be found flourishing in regions far separated from their native haunts; for instance, Chinese species grace gardens in England. The genus is named after Pierre Magnol, a French botanist of the 17th century.

Magpie. This handsome bird is a relative of the jays and ravens, and belongs to the crow family (*Corvidae*). Magpies are from 16 to 20 inches long, with usually glossy blue-black and snow-white plumage, and a long pointed tail; some Oriental species are brightly coloured. The common magpie (*Pica rustica*) is plentiful in agricultural parts of the British Isles. If encouraged, magpies make friends with human neighbours and are easily tamed. The magpie's



John Kearton

CHEEKY, INQUISITIVE MAGPIE

Here he is, the handsome, thieving magpie, whose bad reputation fails to lessen his popularity, for like many rogues he has tremendous charm. Black, with a bluish or greenish tinge, and pure white are the colours of his plumage—hence the "pie" in his name

constant use of its harsh voice has caused the bird's name to be used for a noisy chatterer It builds a large nest, which can be used for several years in succession and which is surmounted by a curious, roof-like platform The whole is often made of thorny twigs and may be placed in a low thorn bush or a hundred feet up in a great elm tree

Magpies are unpopular with Man and with other birds, for they rob their bird neighbours of eggs and young, and they are perhaps the worst thieves in all birdland So, for all his good looks, the magpie is a rather bad sort

In rifle-shooting practice, the outermost ring but one of the target is called the magpie, and so, too, is a shot which strikes it

Mahogany. It was a happy accident which introduced the beautiful wood of the mahogany tree (*Swietenia Mahogani*) to Europe In 1595, when Sir Walter Raleigh was in the West Indies, his ship's carpenter discovered this wood in Jamaica and used it in repairing the vessel It did not become an article of commerce until the 18th century, when English cabinet-makers began to use it, but so quickly did it become popular that in 1753 alone over half a million cubic feet were imported By the end of that century, too, it had been introduced into India, where it is now largely grown

It has since been one of the most highly esteemed woods for fine furniture and interior finishings, because of its beautiful grain and rich reddish-brown colour combined with hardness and durability

Nearly all the true mahogany came from Honduras, though small supplies are obtained from Santo Domingo and Cuba The tree is large and slow-growing, often 100 feet high, with an enormous buttressed trunk sometimes 12 feet in diameter It is now very scarce, being found chiefly in the depths of trackless forests, and the enormous expenditure of money and labour involved in cutting and transportation makes it very costly

The trunks are cut from platforms 12 feet above the ground—a very hazardous undertaking—and the logs are dragged out of the forest by oxen A single tree of large size, if of especially beautiful grain, is worth many hundreds of pounds Because of its value, most mahogany is used in the form of thin sheets, or veneer, glued to the surface of cheaper woods

The true mahogany is a member of the *Meliaceae* or bead-tree family, which is so called because the seeds are used as beads The name is also given to other members of the family, and to unrelated species of trees whose wood resembles genuine mahogany in grain and colour African mahogany, for example, is *Khaya senegalensis*, and furnishes a considerable amount of timber, but of inferior quality and colour In Australia certain kinds of eucalyptus, and in North America species of *Cercocarpus*, are called mahogany

The PROPHET *of* ISLAM *and his* CREED

Second only to Christianity as a missionary-religion, Mahomedanism or Islam is the faith of millions in all parts of the world This chapter tells of the Prophet who founded it and of its distinctive beliefs and practices

Mahomet (570 ?–632) AND MAHOMEDANISM Few romances are stranger than the career of this founder of one of the world's great historic religions Born in Mecca of a good Arabian family, Mahomet (or Mahommed, also written Mohammed) was early left an orphan and was brought up by a poor but kind uncle More than once he went to Syria, the last time in connexion with trade First of all he went with his uncle Abu Talib, when he was a lad of only twelve years of age And, as he grew older, he thought seriously upon all that he saw and heard, in the desert and in the cities, as he travelled backwards and forwards in the course of his calling

The matter that caused deepest concern to the thoughtful young man was the ignorance and superstition of the Meccans and other Arabs, who were idolaters Marrying a rich widow named Khadija, he himself became a merchant, but he continued to brood on the low moral condition of his people At this time the Jewish religion and Christianity flourished in some communities of southern Arabia

Mahomet grew familiar with the teachings and lives of Jesus Christ and the Jewish prophets He was subject to visions, and claimed that his teachings were directed and taught to him by God through the archangel Gabriel

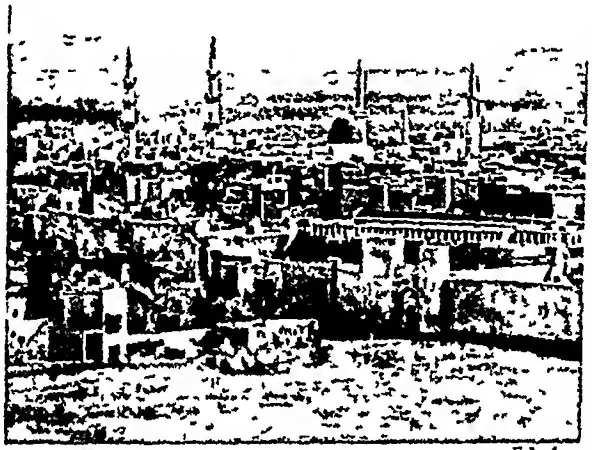
At the very beginning of his mission Mahomet, like other prophets, was fiercely opposed and maltreated by his own family and clan, and from others came persecution so bitter that he was forced to flee from Mecca to the city of Medina, some 250 miles to the north, where some of his supporters had already gone

This flight, or "hegira," of Mahomet (A D 622) is the date from which the whole Mahomedan world reckons time, as we do from the birth of Christ It was also the turning-point in Mahomet's career He had proclaimed himself as the true interpreter of God, as a prophet, and persistently preached to the idolaters and the followers of other religions like Christianity and

Judaism At Medina the Jews were powerful, and Mahomet thought that he could combine with them in furthering his new worship But the Jews refused

After winning a powerful position in Medina, Mahomet declared war against both the Jews and the Meccans When the Arabs began to flock to his standard, he sent messages to neighbouring kings Some of them accepted Islam, as the Mahomedan religion is properly called (the word comes from the Arabic for "to submit to God"), while others refused, and the wars were first declared in self-defence against those enemies who persistently tried to check the teachings of Islam Soon all Arabia was at Mahomet's feet, for the desert Arabs rejoiced at the opportunity which a civil war would give them to plunder the rich Meccan caravans

Mahomet suppressed idolatry, and after the conquest of Mecca, in the eighth year after his flight, all Arabia embraced Islam Non-Moslems were not allowed to enter Arabia He boldly sent letters to all the known kings of Europe and Asia, calling upon them to acknowledge that "there is no God but Allah, and Mahomet is His Prophet" He died at Medina in 632, ten years after his flight His tomb in Medina, as well as the sacred city of Mecca, are places of pilgrimage for all good Mahomedans



E N A

THE CITY OF THE PROPHET

Some 240 miles to the north of Mecca is Medina, to which the Prophet proceeded in 622 and where he died and was buried ten years later His tomb is within the splendid mosque visible in this photograph

From poverty to rich empire, from obscurity to fanatical reverence as the prophet and founder of a great new religion, is the romantic history of this camel-boy of the Arabian desert

Within a hundred years after Mahomet's death, not merely Arabia, but Syria, Persia, Egypt, northern Africa, and Spain had been conquered by Mahomet's victorious successors (called "caliphs") His religion was prepared for yet further extension into Asia Minor, eastern Europe, central and eastern Asia, and the interior of Africa The spread of Roman conquest about the Mediterranean had taken more than four times as long The progress of the Christian religion in its first century was hidden among the humble, and restricted to a very much narrower area

Today Mahomedanism or Islam is the faith of about 210,000,000 people in Asia, Africa, and eastern Europe (There are a few English Mahomedans, too) It ranks fourth in numbers among the great religions, Christianity, the religion of the Chinese Confucius, and the Hindu faith having more followers

Islam's sacred book, the Koran (*q v*), teaches the oneness of God in every respect, and strongly condemns idolatry It lays down clearly the boundary between God and human beings Its prohibitions include gambling, intoxication, and stealing, and it conveys the message of brotherhood and equality to all, whatever their creed or religion may be It teaches kindness towards the weak, slaves, orphans, etc It has raised the status of woman, given to her the right to hold her own property in her own name, and inherit from her father, mother, sons, and other relations just as a man can It states clearly that women have the same rights as have men It teaches reverence to all past prophets and holy books No Moslem may deny or dishonour any of them, for the Koran teaches toleration towards every religion Islam abolished priesthood as a caste and emphasized direct communication between God and men without the intervention of any priest The Koran condemns monasticism and lays stress on cleanliness of body and soul Every Moslem is commanded to try his best to purify his morals, and recognize the sacredness and integrity of knowledge, reason, and thinking The Koran teaches one to detest ignorance and bigotry

Mahomedanism forbids the use of strong drink, or the lending of money at interest Every Moslem must pray five times a day, facing towards Mecca The "muezzins," or criers, give the "call to prayer" in the morning, at noon, and at sunset from the tall minarets standing beside the mosques, or Mahomedan temples

One month in the year, called "Ramadan," is kept as a season of fasting, when Moslems may not eat between dawn and sunset As among the Jews and Hindus, the use of pork, is strictly forbidden Mahomet, at a time when polygamy was an accepted custom, married eleven wives Polygamy is allowed in the Moslem religion, but is limited to four wives at one time, provided the strict conditions laid down are duly observed

There is no truth whatever in the common belief so prevalent in this country that, according to the Islamic Faith, women are not regarded as having souls, or as being admitted to Paradise

The Mahomedan religion is still spreading in different parts of the world It is a fact that no Moslem draws a colour line against other Moslems, whether black, yellow, or brown Formerly the caliph, or head of Mahomedanism, was the Sultan of Turkey The caliphate began with Abu Bekr, father of Ayesha, Mahomet's favourite wife, and has since been handed down from one family to another

There have sprung up in Islam many sects, which, though they differ in minor theological details, yet agree on its fundamentals Chief of these are the Sunnites, or orthodox Mahomedans, and the Shiites or "intellectuals" The latter insist that the descendants of Ali, husband of the Prophet's daughter Fatima, are the only legitimate caliphs Persia today is the stronghold of the Shiites But all Moslems in common make pilgrimages to Mecca and Medina

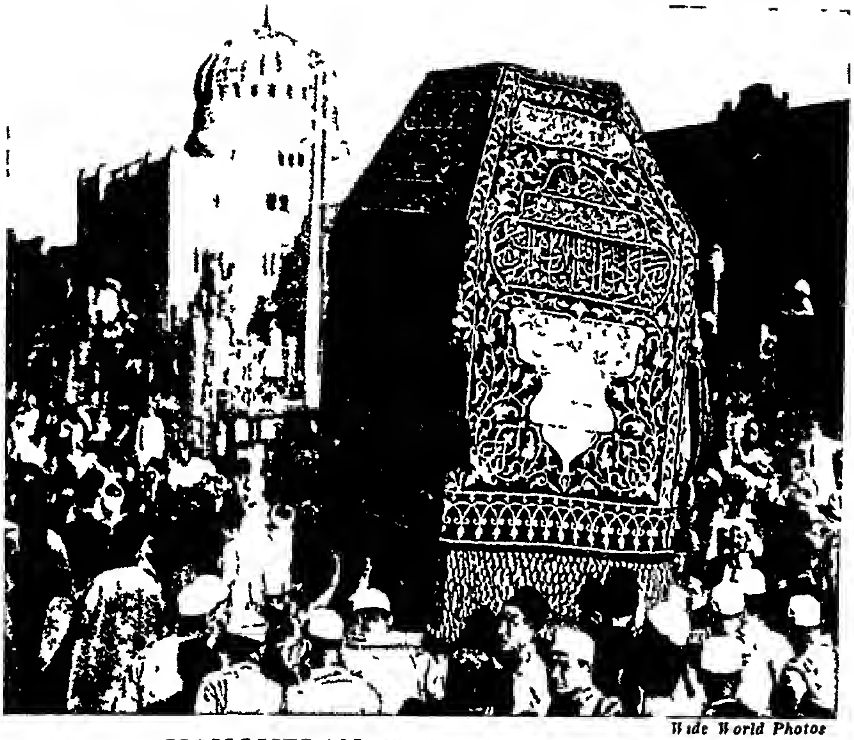
The "Saracens," as followers of Islam were called in the Middle Ages, passed from Africa into Spain in 711 At the famous battle of Tours in 732, exactly 100 years after Mahomet's death, the Mahomedan invasion of France was halted by Charles Martel, grandfather of Charlemagne Driven back into Spain on the west, and held in check by the Byzantine Empire at Constantinople, the Arabs, Moors, and other Mahomedan peoples settled down in their new won lands and developed from the 8th to the 12th centuries a culture which far surpassed that of western Europe

Among many other centres of this culture were Damascus, in Syria, Baghdad, on the river Tigris, Cairo, on the lower Nile, Cordova, in

MAHOMEDANS AT PRAYER

The top photograph shows Mahomedan worshippers in the Sahara during the fast of Ramadan in the third of the attitudes of prayer, which is complete prostration The lower photograph shows a muezzin calling the faithful to prayer from the minaret of a mosque in Tripoli Mahomedans always turn towards Mecca when they pray

Photo E N A



MAHOMEDAN FESTIVAL IN CAIRO

Every year the Holy Carpet, which is made in Egypt, is carried in a pilgrimage to Mecca, where it is used to cover the Kaaba (the shrine containing the sacred black stone) during the ensuing year This photograph shows the carpet being carried through the streets of Cairo In page 2688 is a picture of the carpet in position

Spain, and Delhi, in India Here were gathered together the threads of civilization drawn from Greece, Persia, Syria, Egypt, India, and Spain Agriculture made great strides Irrigation was practised extensively, and tree-grafting became a science Among new plants introduced into Europe from the Arabs—especially during the Crusades—were rice, sugar-cane, hemp, artichokes, asparagus, the mulberry, orange, lemon, and apricot

In manufactures the Saracens excelled The sword blades of Toledo and Damascus were world-renowned Equal skill was shown in the fashioning of vases, lamps, and like articles of copper, bronze, and silver, in the weaving of carpets and rugs, which are still unsurpassed, in the moulding of fine glass and pottery Sweetmeats, syrups, essences, and perfumes were produced Paper, without which the invention of printing would have been valueless, came to Europe through the Mahomedans The finest leather goods came from Cordova and Morocco

In literature, particularly poetry, and in science the Mahomedans attained a high degree of development The University of Cairo at one time had 12,000 students In Spain in the 10th century a library of 400,000 manuscripts is said to have been collected Learned Arabs did much to preserve and spread broadcast the writings of the great Greek philosopher Aristotle, after he had been all but forgotten in western Europe In mathematics and algebra Mahomedan scholars led the world

The so-called "Arabic" numerals which we use today were introduced by them In astronomy, medicine, and chemistry they made notable advances The richness and grace of their architecture is evident in all their lands

Maine, U S A This is the most north-easterly of all the states of the U S A, and has a deeply indented coast line on the Atlantic The well-wooded interior is very mountainous, and is well stocked with fish and game The holiday resorts include Acadia National Park Lumber, wood pulp, and potatoes are the principal products The state capital is Augusta (population, 14,000), and the largest town Portland (pop, 70,000)

The area of Maine, which was originally part of Massachusetts, is 29,895 square miles and the state's population is about 800,000

Maize. Known also in this country as Indian corn, and in America simply as corn, maize (*Zea mays*) has a variety of other names in other parts of the world It is a stout annual grass, and in every way is much larger in growth than any other sort of corn

MAIZE FIELD IN FLOWER

"Corn," as maize is called in America, is one of the most important cereal crops, for each plant yields a number of "cobs," which make delicious eating and are ground into flour This field of maize is in Santa Fe province, Argentina

It is generally associated with tropical America, and was cultivated there long before Columbus discovered that country. Not only is it the largest, but it is also one of the handsomest of the grasses cultivated for food. The plant itself when growing luxuriantly presents a most pleasing appearance, for it attains to a height of from 5 to 6 feet, and has very long, broad leaves, while the beautiful head of pink flowers is unsurpassed in any other grass.

Maize is extensively grown in North and South America, South Africa, Rhodesia, and in Mexico, where the farmers put it to various uses; it is even used for making bread, but it does not make a good loaf, judged by British standards. Richer in oil properties than any other cereal, it is extensively used as a fattening agent, in oil-cakes and for cattle food. "Corn on the cob," too, has come to be regarded in Britain as a characteristic American dish.

There are believed to be fully 300 varieties of the plant, and they differ greatly. Some come to maturity in two months, while other varieties require as long as seven months.

LIFE *in the* LAND *of* RUBBER *and* TIN

Within the mountainous, jungle-clad peninsula of Malaya lie a large number of states—some savage and some in a reasonably high stage of civilization, but nearly all under British guidance

Extent.—Total area of British Malaya (Straits Settlements, Federated Malay States, and Unfederated Malay States), 53,200 square miles; population 4 934 000
Physical Features.—A vast forest, intersected by countless rivers; backbone of granite mountains
Principal Products.—Rubber, tin, copra, palm oil
Chief Towns.—Singapore, seat of government (445,000) George Town (154,800), Kuala Lumpur (114,000)

Malaya. No human eye has ever seen more than a small fraction of the Malay Peninsula—that long diamond-shaped arm of land that trails off to the south and south-east from the Indo-Chinese peninsula of Asia. Its whole length of 750 miles is one vast jungle, but it is intersected by many streams—the only roadways of the interior.

The rich soil, in one of the hottest and dampest climates in the world, is covered with a bewildering tangle of giant trees, creepers, trailing plants, and undergrowth so dense that even the wild beasts travel only in well-worn paths. Ferns and rank grasses hide the soil. This tangle of vegetation harbours myriads of leeches, centipedes, scorpions, wasps and stinging flies, pythons and cobras, ants and mosquitoes, parakeets, and many songless birds of brilliant plumage. Smooth black buffaloes with pointed horns, elephants, and tigers are plentiful. There are black leopards and honey bears, tapirs and deer, and the rare Malayan antelope; and the lumbering rhinoceros wallows with the alligator in noisome swamps.

Along the swampy banks of the rivers live the strange people called the Malays. The typical Malay is short, thick set, and well built, with straight black hair, a dark brown complexion, thick nose and lips, and bright intelligent eyes. He is very suspicious, courageous, and, generally, extravagant; a gossip, a Mahomedan and fatalist, and very superstitious.

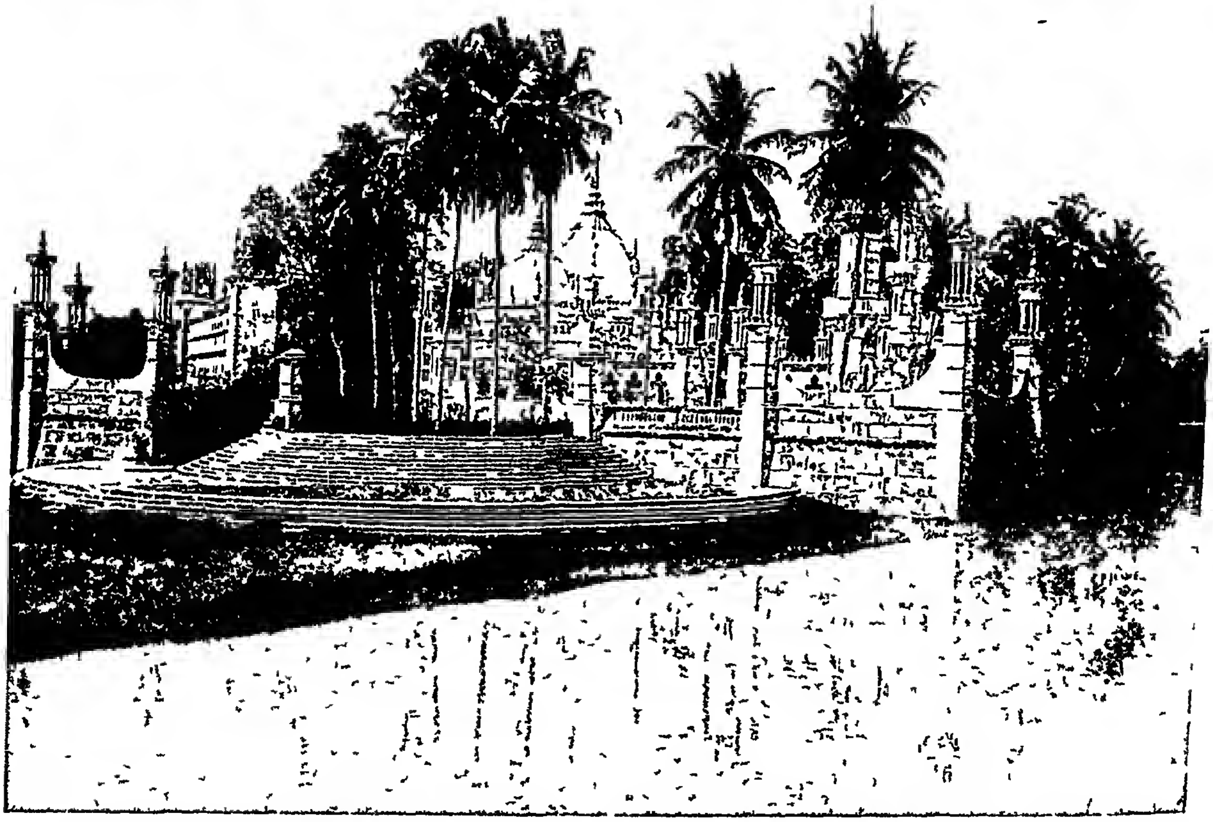
He is conservative, proud and fond of his country and his people. He is clever but infinitely lazy. He loves power and place; his soul hankers after honours. He plays at trade sometimes, but almost always fails to make a living at it, because he knows nothing of method or order. His house is untidy, even dirty; but he bathes twice a day and is very fond of gay clothes—especially the soft-toned cotton and silk *sarong* which both men and women wear draped round the waist to make a sort of skirt.

The Malay village is usually a cluster of huts on piles, built of bamboo and palm leaves or sometimes of wood and thatch. The houses are never close together, but within sight and call of each other, shaded by tall coconut palms and a few fruit trees—the dark-leaved mangosteen, the mango with its brilliant magenta blossoms, and the durian, that tree of magnificent dimensions which produces the golden spike-studded fruit so relished by the natives. Behind the *kampong* (enclosure) are fields of rice, irregular golden islands of it running back into little valleys, at the foot, perhaps, of the long mountain chains that rise range upon range into the heart of the peninsula. This rice, with fish forms the staple diet of the people.

People of the Malay States

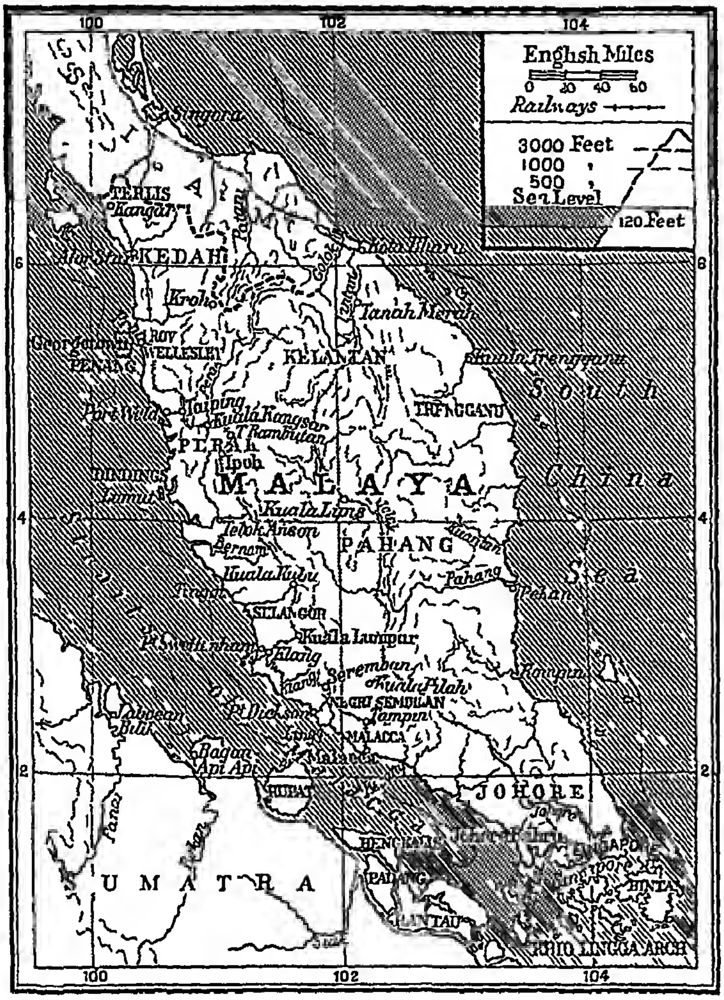
About two fifths of the population of the peninsula are Malays, but the bone and sinew of the Malay States are the Chinese, who compose another two fifths of the total and are the labourers, miners, shopkeepers, and contractors, who contribute almost the whole of the revenue. In the mountains are still found about 20,000 of the aboriginal inhabitants—the woolly-haired negroid Semangs, who support themselves by fishing and hunting, and the Sakais, who build their houses in forked trees, and who formerly obtained all their meat by

SOCIAL CONTRASTS IN PRESENT-DAY MALAYA



The homes of the people of Malaya are notable for their untidiness, and rubbish and unwanted odds and ends are thrown out and make such litter as that seen in the photograph top left. The walls of these houses are of interlaced bark, and they are raised from the ground to keep out four-footed intruders. At the top right are two Malayan girls, whose elaborate frocks prove that their parents belong to the more prosperous class. The lower photograph shows the famous mosque which is the glory of Kuala Lumpur, the capital, with its towers and balustrades reflected in the waters of the Klang river

Photos J Cummins and Malayan Information Agency



MALAYA—SOUTHERN EXTREMITY OF ASIA

poisoned darts shot from blow-pipes The Tamils, sent from southern India to work on the rubber plantations, number 100,000 Rubber, tin, copra, tapioca, and spices are the chief exports

Politically the peninsula consists of the southern province of Siam, the British Crown Colony called the Straits Settlements (which includes the small islands of Singapore and Penang, the town and territory of Malacca, and also Labuan, an island near Borneo), the four Federated Malay States (Perak, Selangor, Negri Sembilan, and Pahang), under British protection, and five non-federated Malay States (Johore, Kedah, Perlis, Kelantan, and Trengganu), under British protection since 1909

The city of Singapore (*q v*), founded in 1819 by Sir Stamford Raffles, from which the Straits Settlements are administered, is on a small island at the extreme tip of the peninsula The Malay Archipelago, or East Indies, whose numerous islands stretch eastward for 4,000 miles, is in many senses a continuation of the Malay Peninsula, it is described under the heading East Indies

It was not until the 16th century that the Malay Peninsula became known to Europe, through the Portuguese Then it was sought for its spices, and not until recently has the peninsula become known for its mineral wealth Today it furnishes more than one-half of the world's supply of rubber, and nearly two-thirds of the tin used in the world Malacca, where the Portuguese founded their spice monopoly, became famous because from the 16th to the 18th century trade between the Arabian Sea and the Indian Ocean centred on this point The English and Dutch succeeded to the Portuguese trade in the East, and when the Dutch power declined in the 18th century, the English gained the ascendancy Until 1867 the Straits Settlements were governed from India Population of British Malaya, about 4,900,000, area, about 53,200 sq miles

Mallow. This is one of the commonest flowers of the wayside, where you may see it in summer, often covered with dust, but still showing its pale, reddish-mauve blooms above a mass of soft, hairy, round green leaves The common mallow (*Malva sylvestris*) is found all over Britain, but our other species, such as the dwarf mallow, with much smaller flowers and leaves, and the lovely musk mallow (*Malva moschata*), are less widespread The latter has large pink flowers, and its leaves, though their general outline is really circular, are so deeply cut that they have a curiously ragged look The fruits of the mallows consist of a number of kidney-shaped seeds, arranged in a circular mass like an orange's sections,

ROADSIDE MALLOW

This pretty plant is very common by the side of the country road, but it is usually so dusty that you cannot appreciate its beauty The round leaves as well as the stems are very hairy, and they hold the dust that is blown on to them

Photo E J Hosking

this shows their relationship to the hollyhock (*q v*), a member of the same family The tree mallows (*Althaea*) are larger forms which reach a considerable size, you may see them in gardens, especially near the seaside

Malt. Barley or other grain that has been artificially germinated or sprouted by moisture and heat is called malt In the older and simpler method of malting, the grain is steeped in cisterns for from 48 to 100 hours at a temperature of about 55° Fahrenheit It is then spread on a floor in heaps to germinate for several days, and finally it is further heated and dried in kilns to stop germination In the malting process various ferments or enzymes are produced, especially diastase, which has the power of changing starch into sugar and is of great importance in the process of digestion

The greater part of British malt is used in brewing beer, which is made from a mixture of malt (chiefly barley malt), various unmalted grains, hops, and water, to which yeast is added to produce fermentation It is also largely used in making malted milk, which is a mixture of powdered milk and powdered malt It is also used in making invalid and baby foods, for the starch of the grain is made more digestible in the process of malting, some of it is actually changed into sugar and other products soluble in water A solution of malt products, evaporated to a thick consistency until it looks like brown syrup, is used in bread making

A STEPPING-STONE *to the* EAST

With Gibraltar and Cyprus, Malta forms a chain of British outposts in the Mediterranean and safeguards our shipping paths through the Suez Canal to the East Thus, though a small island, it has great importance

Extent —Area of colony, 122 square miles, population, 241,620
Physical Features —Hilly islands, with an indented coastline
Principal Products —Cotton, wheat, barley, and other crops, vegetables and fruit
Chief Town —Valletta (capital), 48,000

Malta. In June, 1798, while on his way to Egypt, Napoleon Bonaparte seized without resistance the small island of Malta, in the Mediterranean Sea, which was then ruled by the Knights of Malta—the last of the famous Crusading Orders of the Middle Ages Three months later a British fleet, aided by Maltese rebels, besieged the garrison of French soldiers left behind by Napoleon The garrison held out for two years, but finally surrendered

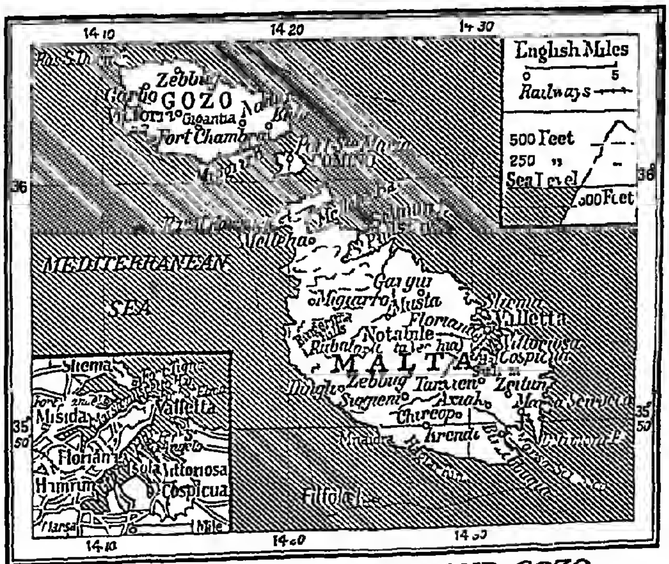
In this manner Great Britain came into possession of that important strategic point, which, with the very powerful rock fortress of Gibraltar, gives her today predominant naval control of the whole of the Mediterranean

It is now strongly fortified and garrisoned, and is considered one of Britain's important naval and air bases

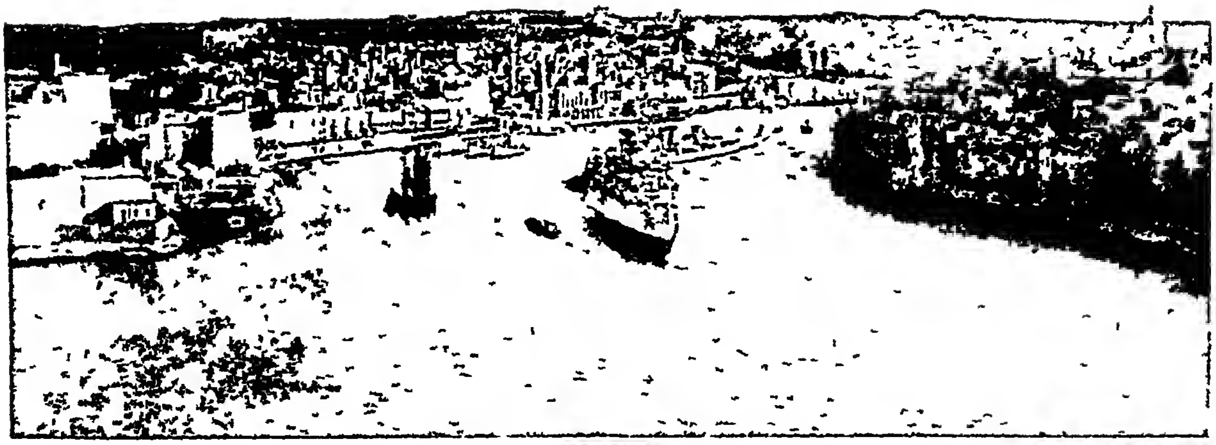
Inhabited originally by the ancient Mediterranean race, whose great stone monuments are still visible, Malta was colonized by the Phoenicians perhaps 900 years before the Christian era, and in the 6th century B C the Carthaginians ruled there Then in succession through the centuries came Romans, Byzantine Greeks, Saracens, Normans, and Spaniards, until the Emperor Charles V, in 1530, gave the island to the Knights Hospitallers of St John, who had just been driven out of the island of Rhodes by the Turks Adopting the title Knights of Malta, they defended themselves against Turkish attack in the famous siege of Malta (1565), and maintained their rule until the surrender to Bonaparte in 1798 The Knights of Malta still exist as an honorary order, with headquarters at Rome The white eight-pointed Maltese cross is the badge of the order

Malta lies 59 miles south of Sicily, and about 180 miles from the African coast The island with its low hills is only 17 miles long and 9 miles broad, but near by are the smaller islands of Gozo and Comino, which make the total area of the British colony 122 square miles

The climate is temperate, and, except for occasional outbreaks of Malta fever, due to a



THE ISLANDS OF MALTA AND GOZO



VIEWS OF MALTA'S CAPITAL

Above is a part of the harbour of Valletta with the old fort, originally built by the Moors, on the right of the photograph The lower photograph shows the Strada Santa Lucia one of the narrow streets of old Valletta, so steep that it is ascended by a series of steps

germ found in goat's milk, it is healthy The country people, who cultivate tiny farms terraced upon the hill-sides, are largely descendants of the Phoenicians and speak a dialect of mixed Phoenician, Arabic, and Latin origin There is a large admixture of Italians, Greeks, Turks, Jews, Arabs, and all the other races which traffic up and down the Mediterranean English is taught in the schools, but the official language has been Maltese since 1934

A dispute arose during 1930 between the Governor of Malta and the Roman Catholic Church The British Government suspended the Constitution and sent out a Commission of Inquiry The Constitution was restored on this Commission's recommendation, but further disputes arose over the decision to replace Italian by Maltese as an official language Malta became a Crown Colony under a new Constitution proclaimed in 1936, the rights of self government being revoked

In 1939 a new Constitution was proclaimed by which ten members of the Council of Government are elected

The chief products of Malta are cotton, potatoes, onions, grain, and tropical fruits, but food has to be imported every year to supply the needs of the dense population The capital and chief port is Valletta or Valetta, with a population of about 48,000 It contains many interesting buildings, notably the Grand Master's palace and St John's Cathedral The Grand Harbour of Valletta, headquarters of the Mediterranean Fleet, is one of the finest in the world Its strategic and commercial importance lies in the position of Malta mid-way between Gibraltar and the Suez Canal Notabile (Citta Vecchia), inland, was once the capital Another historic place is St Paul's Bay, the supposed scene of the great apostle's shipwreck when en route for Rome in A D 58

The population of the colony is about 241,000

At the TOP *of the* TREE *of* ANIMAL LIFE

Most animals that are born "alive" are mammals, and this group includes all the four-legged, and some other, creatures, as well as Man himself. How and why mammals differ from other groups is explained here.

Mammals. Mammals are the highest forms of animal life in the world. Altogether there are about three thousand species of them, and they range in size from the elephant to the shrew, or in appearance from the lion to the giraffe, or from the kangaroo to the whale. Certain features they have in common, however, which are not possessed by other forms of animal life.


Monkey, a higher mammal

Birds, reptiles, and insects lay eggs from which their offspring are hatched. Young mammals, on the other hand, are born alive, sometimes blind and helpless, and sometimes able, after a few hours, to run about with their mother. But there are exceptions in the Monotremes, such as the Echidnas and the duck-billed platypus, or *Ornithorhyncus*, which lay eggs and hatch their young from them. (*See* Duckbill.)

Reptiles and amphibians have four legs, but their bodies are covered with scales instead of with hair. So mammals may be described as four-limbed animals wholly or partly clothed with hair. This in some species forms a thick warm coat which enables them to exist in the coldest climates. In many it is beautifully coloured and marked with bars or spots—for example, the tiger and zebra and the giraffe and leopard. It has become a handsome decoration in the mane of the lion, and a very graceful one in the mane and tail of the horse.

How beautifully soft and velvety is the "fur coat" of the mole and the seal! The seal, however, and many other mammals have a short, thick, warm under-fur which is covered by a coat of longer and coarser hair. This outer covering is removed when sealskin coats are made. The elephant, the rhinoceros, the hippopotamus, and the pig have only the coarse outer coat and very little of that, and the hair of the pig has become stiff bristles.

In the hedgehog and the porcupine the hair has become a means of defence; it has been hardened into strong sharp spines which wound the mouth of an attacking enemy. In the rhinoceros, hair even actually goes to form the large pointed horn on the top of its snout.

Again, the cat and some others have long stiff whiskers standing out on each side of the muzzle. These serve as feelers which enable the animal, when it is hunting, to judge, without turning its head, whether an opening in the undergrowth is wide enough for its body to pass through without brushing the plants on either side and so making a noise that would startle its prey. Whales are mammals, yet many of them have no hair on their bodies. The thick coat of blubber which is under their skin serves instead to keep them warm.

Furthermore, the whales have only two limbs. They have completely lost their hind-legs. As the whale swims entirely by means of its tail, hind-legs would be not only useless to it but also very much in the way. Still, in the skeleton of the whale there are bones which prove that once upon a time it had four limbs. The fore-legs of the whale have been changed into flippers. The bones of the toes are joined and covered by flesh and skin so as to form a flat paddle.

In some other kinds of mammals the fore-limbs have also been changed. The bats use them for flying. For this purpose four of the toes have been very much lengthened, and between them has been stretched a delicate skin, which also extends from the fourth toe to the body and the hind-leg. In the monkeys, the apes, and also in Man, the fore-legs have become arms with hands instead of feet.

Different Ways of Walking

Some of the mammals walk on the soles of their feet—for example, the bear, the otter, the weasel, and the hedgehog; whereas the dog, the cat, the horse, and many others go on their toes. These two types are called *plantigrade*, from Latin for "sole" and "walk," and *digitigrade* (Latin, *digitus*, finger) respectively. In some species which depend for safety on speed—for example, the deer, the horse, and the camel—all four limbs are long. These are the animals that run swiftly. The kangaroo has another method. Its fore-legs have become very short and are useless for running, but its hind-legs are large and powerful, and it sits up on them and springs along.

All mammals except the whales have their toes armed with claws or nails. The cats have sharp claws for catching and wounding their prey. When these are not in use they can be withdrawn into sheaths so that the points may not be blunted. The dog's claws are blunt,

SOME MEMBERS of the FOUR GREAT GROUPS of MAMMALS

On this page are illustrated representatives of the four chief groups of mammals At the top is a sable antelope (Ungulata), immediately above are two chimpanzees (Primates), above right is a snow leopard (Carnivora), and on the right below is a black rat (Rodentia)

Photos Berridge (top and bottom) Bond (left) Keystone (right)

Mammals may also be distinguished from all other animals by the fact that they have different kinds of teeth Reptiles and fishes have many teeth, but they are all of one kind, sharp spikes by which they can hold their prey On the other hand, mammals have four kinds First there are the chisel-like front teeth, called incisors, which are used for seizing and biting through food Next, and on each side of them, there are four sharp-pointed teeth, called

and are used only for scraping or scratching, and cannot be withdrawn The sloth's are long and hooked, and by means of them it hangs upside-down on the branches of trees, and the ant-eater's are large, powerful weapons with which it breaks open the ant-hills In the monkeys, the apes, and Man the claws have become the nails

One large group of mammals, which includes the horse, the deer, the ox, the sheep, the camel and the pig, actually walks on its nails These have been very much enlarged so that they surround the tip of the toe, and they have been given the special name of hoof

MAMMALS THAT LIVE IN THE SEA

The seal which you see in the upper photograph, although it spends its life in the sea, is actually a member of the carnivorous mammal group, a relative of the cats and their allies But the whales, a stranded shoal of which you see in the lower picture, are members of their own special order, Cetacea, although they are also true mammals, in spite of their superficially fish-like appearance

Photos top James bottom Topical

The full number of toes on the foot of a mammal is five, but many species have fewer The pig and the deer have four, though they use only two, the sloth has three, the ox and the sheep have two, and the horse has only one

The tail is used by some mammals as an extra limb Among the kangaroo tribe it serves as a support, like a third hind-leg, when the animal is sitting In the opossum and the spider-monkey it can be twined round a support, and by doing this the animal can swing itself from branch to branch It is the organ by which the whale is able to swim The horse and cattle use it to brush flies from their sides

canines or dog-teeth, with which the animal tears its food At the back of each jaw are several large teeth with a broad rough surface, which serve to grind food These are called molars, and between them and the canines there are two or more smaller teeth for chewing, the premolars

Man and the apes and monkeys have all four kinds, because their food is varied Tigers and wolves and other flesh-eating animals have small incisors, but large, strong, and sharp canines, and narrow molars with sharp points

The horse and ox and their many cousins which live upon grass and other herbage, have good incisors and also large molars, because their food requires much grinding, but only

small canines The rat, the squirrel, the rabbit, and other rodents which nibble for a living, have long, sharp incisors and no canines The elephant has no need of incisors, because it places food in its mouth with its trunk, but it has kept two of these and grown them into tusks

The wild pig has developed its canines into fierce-looking weapons which curve out of its mouth on each side

One group of mammals, to which belong the sloth, the anteater and the armadillo, have, as a rule, no teeth, and some whales have a large number of teeth all alike resembling those of fish

There is one habit, however, that is practised by all mammals, and by which they may be easily recognized It is that they nourish their young with milk until they are old and strong enough to eat more solid fare This is done by no other animal creature

F B Bond

HYRAX, A STRANGE LITTLE MAMMAL

You would certainly never guess what other mammal is this little fellow's nearest relative, nor even to which group it belongs For the hyrax, although it climbs trees, is a hoofed beast, and its closest relative is the elephant himself! This sort of hyrax is found in Africa

When at length we have decided what mammals are, we find it necessary to arrange them in groups on account of their many differences In each group we place all those animals which, though they may be remarkably unlike in general appearance, have yet some special habit or type of organ in common There are three main divisions, of which the first two have only a single group each as you see from the following table

(1) *Monotremes* (egg laying mammals like the duck billed platypus) (2) *Marsupials* (the kangaroo and other animals which carry their young ones in a pouch like a pocket of an apron) (3) *Placentals*, containing all the other groups as follows, (a) *Ungulata* (all hoofed animals including elephant, rhinoceros hippopotamus horse pig deer ox, and sheep) (b) *Sirenia* (manatee and dugong water animals somewhat like whales) (c) *Cetacea* (whales and dolphins), (d) *Carnivora* (flesh eating animals such as cat, dog bear, seal weasel) (e) *Rodentia* (gnawing animals, such as squirrel, mouse, rabbit), (f) *Insectivora* (insect-eaters—hedgehog, shrew), (g) *Chiroptera* (flying mammals—bats), (h) *Primates* (mammals with hands—lemur monkey, ape, Man) Besides these there are some degenerate groups such as the *Edentata* (ant-eaters, sloths and armadillos)

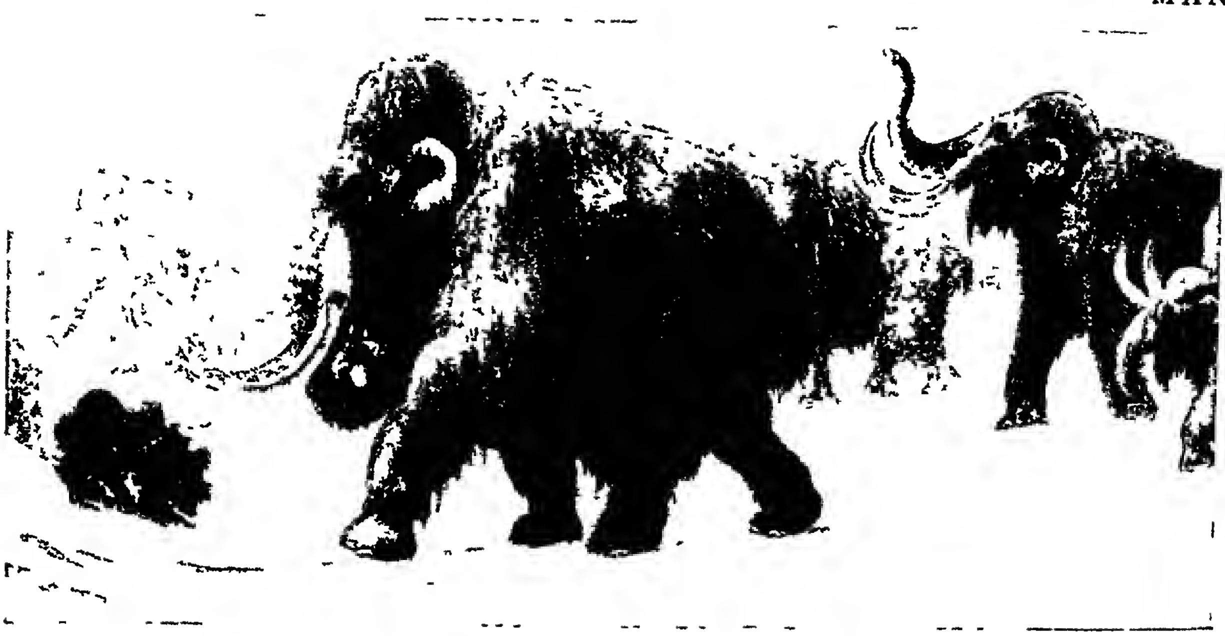
H S Berridge

LAZY SLOTH AT REST

As a representative of those degenerate animals which are grouped together as Edentates—because they have no teeth—you see here a sloth so called because of its sluggish habits It spends its days hanging downwards from trees in the jungle

Mammoth AND MASTODON In various parts of the world are found the bones and other remains of these enormous, prehistoric elephants Also on cave walls in Europe are found drawings which show that men of the Stone Age hunted these monsters Both the mammoth and the mastodon were about the size of the largest Asiatic elephants of today, but, unlike living elephants, their tusks were curved upward and their bodies covered with hair The mammoth especially had a shaggy coat of long hair

The largest tusks discovered measure about 12 feet in length and weigh 250 lb



HUGE MAMMOTHS, MIGHTIEST OF PREHISTORIC BEASTS

Here, marching across country with ponderous tread, you see a herd of the enormous woolly mammoths that thousands of years ago roamed the earth We know just what they were like, too, for in Arctic Siberia their carcasses have been preserved for thousands of years in the frozen soil For all their size, these creatures fell victim to the crude stone weapons of our prehistoric ancestors, as we know from remains found in Britain and elsewhere

American Museum of Natural History

These tusks are sufficiently common in Siberia to supply much of the ivory of commerce At least 100 pairs of tusks have been sent to market annually for the past 200 years These great animals fed upon the shoots and cones of the fir and pine forests of those far-off days, and were overwhelmed or caught in bogs or quagmires, being preserved ever since in the intense cold, even their meat being edible Besides being common in Siberia, they were abundant also in England, Central Europe, and North America

How MAN *became* LORD *of* CREATION

"What a piece of work is Man!" Shakespeare's words have often been echoed by historians and scientists, as well as by ordinary men And truly Man's history is the most wonderful story one could wish for

Man. Science can do little more than guess at the period when Man first made his appearance on this earth Bones buried in ancient soils, rude weapons chipped from stone, carved bits of horn and ivory, pictures of animals long since extinct found on the walls of forgotten caves—these provide the material with which scientists are slowly and patiently piecing together a few details of Man's early existence

"Neanderthal Man"

This much we know, that Man existed many thousands of years earlier than was formerly believed Indeed, it is certain that the prehistoric period of Man's existence was vastly longer than the period covered by recorded history For history, in the restricted sense, does not begin until about 4000 or 3000 B C, when the art of writing seems first to have appeared, while stone tools or artifacts have been discovered which scientists date back many thousands of years To this we must add the unnumbered generations that elapsed before Man learned to make such tools

Boucher de Perthes, a French antiquarian, announced in 1846 that during excavations at Abbeville in northern France he had found ancient flint implements in gravel that contained the bones of elephants, rhinoceroses, and other animals that are no longer found in France His announcement was scorned and discredited for several years In 1859 Sir Joseph Prestwich, a qualified English geologist, went to Abbeville to see De Perthes' collection and examine the gravel beds He came away convinced that the flint implements were the work of Man, that they were found in undisturbed ground, that they were associated with the remains of locally extinct animals, and that the period represented preceded historic times

Various lines of inquiry have now provided evidence of the existence of Prehistoric Man in an early stage of culture The scientists who study the ancient objects of the prehistoric period are called archaeologists, while those who study Man are called anthropologists (*See* Anthropology) To the aid of these comes the geologist, who knows about the formation of the earth and the age of rocks He can tell the age of relics by the amount of soil that time has deposited on them, or by their place in the rocks When fossil bones are found, a palaeontologist supplies facts about the extinct animals, and a highly-skilled anatomist is needed to study the human remains

How evidence on Early Man is pieced together by the co-operation of various scientists, each highly skilled in a special subject, can best be illustrated by the story of the Peking Man, known to science as *Sinanthropus pekinensis* In December, 1929, the world was amazed by news flashed from China that an undamaged human skull had been unearthed from cave deposits near Peking—deposits believed to be 500,000 to 1,000,000 years old!

The discoverer of the site was Dr J G Andersson, a geologist from Sweden The director of the excavations, and the man who actually found the human remains, was W C Pei, a member of the Geological Survey of China The scientist who studied the remains was Prof Davidson Black, a Canadian anatomist The archaeologist who co operated in the work was Père Teilhard de Chardin, a Catholic priest, and president of the Geological Society of France

Besides yielding a perfect brain case, the excavations brought to light human teeth, jaw bones, and numerous skull fragments from several individuals Quantities of associated animal bones, the remains of cave-bears, giant beavers, and primitive deer, made it possible to determine the geological age precisely Fortunately, too, Dr Andersson had dated the deposits before the first trace of Man was found, and subsequent discoveries confirmed the first opinion that they must be ascribed to the early Pleistocene, the geological period which preceded the dawn of our modern world

The skull itself is characterized by a receding forehead, with massive eyebrow ridges, and its bones are enormously thick as contrasted with the skull bones of Modern Man The teeth are of the human type, but the jaw ridges are very massive, a feature correlated with a powerful jaw mechanism In brain, the Peking Man was just within the minimum human standard

MAN A MILLION YEARS AGO

In December 1929 the skull known as the "Peking Man" was unearthed in deposits that may, geologists say, be a million years old From the shape of the skull A Forestier made this drawing, to show what the half-ape half-man, our earliest known ancestor, probably looked like

The search was continued, and two years later Mr Pei announced that artifacts (man-made objects) in considerable number had been found in the cave, as well as evidence of the use of fire These new discoveries indicate that human life was intelligently organized at the time of the Peking Man

Previous finds in other parts of the world had made us acquainted with three prehistoric types of comparable age, but the evidence submitted was not as complete as that pertaining to the Peking Man Anthropologists tell us that in Java during early Pleistocene times there lived a strange creature known as *Pithecanthropus erectus*, the "erect ape-man" Its existence was recognized by the discovery of the top of a skull, three molar teeth, and a thigh bone found scattered in the gravel of a river bed near Trinil in the island of Java The size of the brain was about midway between the brain of a chimpanzee and the brain of the lowest type of human being alive today Although discovery of these fossil remains was announced in 1894, anthropologists still debate whether this being is to be regarded as Man or ape, or a form between the two

The famous "Piltdown skull," another fossil of early Pleistocene age, found in a gravel bed in Sussex in 1911, has also been the subject of vigorous controversy The skull is distinctly human, but the chinless lower jaw with its large canine teeth is truly apelike It is

A VERY EARLY ENGLISHMAN

This illustration gives an artist's idea of the appearance of the very first inhabitants of England An animal's skin forms the man's only clothing, and he carries in his hand a spear with a flint head Such a man as this was among our ancestors 200,000 years ago

Drawing by A Forestier

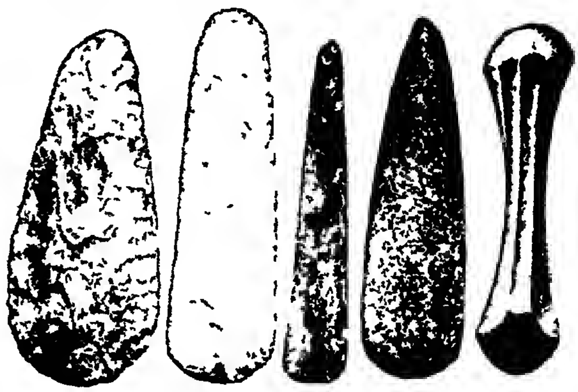
uncertain whether the jawbone and skull really belonged to the same individual The Piltdown fragments were described by their discoverer as evidence of *Eoanthropus*, the Dawn Man

Still another old relic of Primitive Man is a lower jaw found near Heidelberg, Germany, in 1907, from which the whole skull has been reconstructed by the methods of comparative anatomy Interpreting this fossil we picture an individual of undoubted human character, yet differing widely from any modern race The jaw is massive and large, and entirely lacks the chin projection From the fact that the overlying earth was 80 feet deep and that near by were the remains of extinct species of elephants and rhinoceroses, the age of the Heidelberg Man has been put at 200,000 years

Now we must skip a long period without any known human remains and come to the Neanderthal people, so named because the remains of the first recognized member of this race were found in a cave in the district of Neanderthal near Dusseldorf, Germany Many other remains of the same type have since been found in various parts of Europe, from which much valuable information has been obtained The Neanderthal race is supposed to have lived somewhere between 50,000 and 100,000 years ago Its members had acquired considerable skill in making stone weapons, lived in rock shelters, used fire, and hunted small game They apparently buried their dead with some care The Rhodesian Man, whose skull and bones were discovered in Central Africa, is believed to be of the general Neanderthal type, though in some respects the evidence points to a more primitive type

Cro-Magnon Cavemen

The Neanderthal race seems to have been exterminated by a people of far higher culture called the Cro-Magnons, from the cave in France where their remains were first discovered (*See* Cave Dwellers) Whereas the earlier types are often classed as separate species of mankind (*Homo heidelbergensis*, *Homo neanderthalensis*, etc), the Cro-Magnons are recognized as belonging to the same species (*Homo sapiens*) as modern men They were tall and strong, and, if we are to judge from their paintings on the walls of their caves as well as from their skull measurements, they were exceedingly intelligent people Mixed with the Cro-Magnon remains have been found bones belonging apparently to a people of the negro type, called the Grimaldi race, but their origin is much disputed The Cro-Magnons appear to have been either driven out of Europe or assimilated by the Late Stone Age peoples

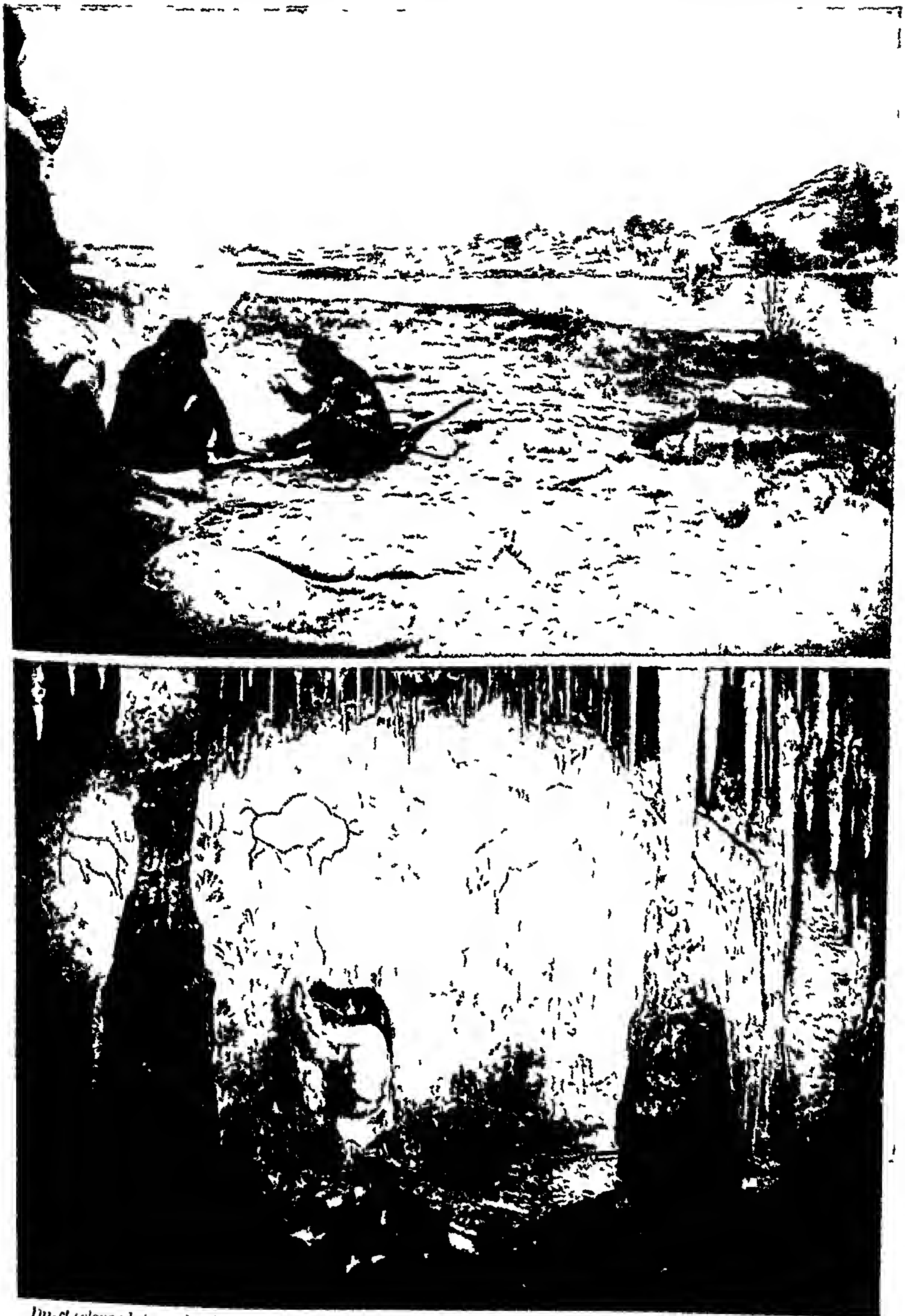


MAN'S EARLIEST TOOLS

In the Stone Age men began to make implements from flints, and during the Neolithic period progress was made from chipped to polished flints The three examples of implements on the left are chipped, while the two on the right are polished

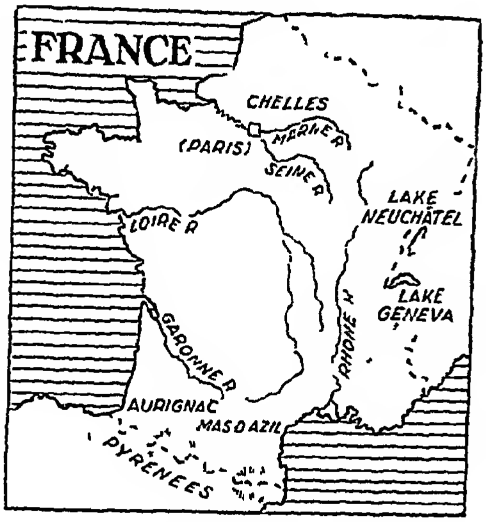
British Museum

THE 'DAWN MEN' AND THE CAVE-DWELLERS



Direct colour photographs of museum groups *See text overleaf*

THE 'DAWN MEN' AND THE CAVE-DWELLERS



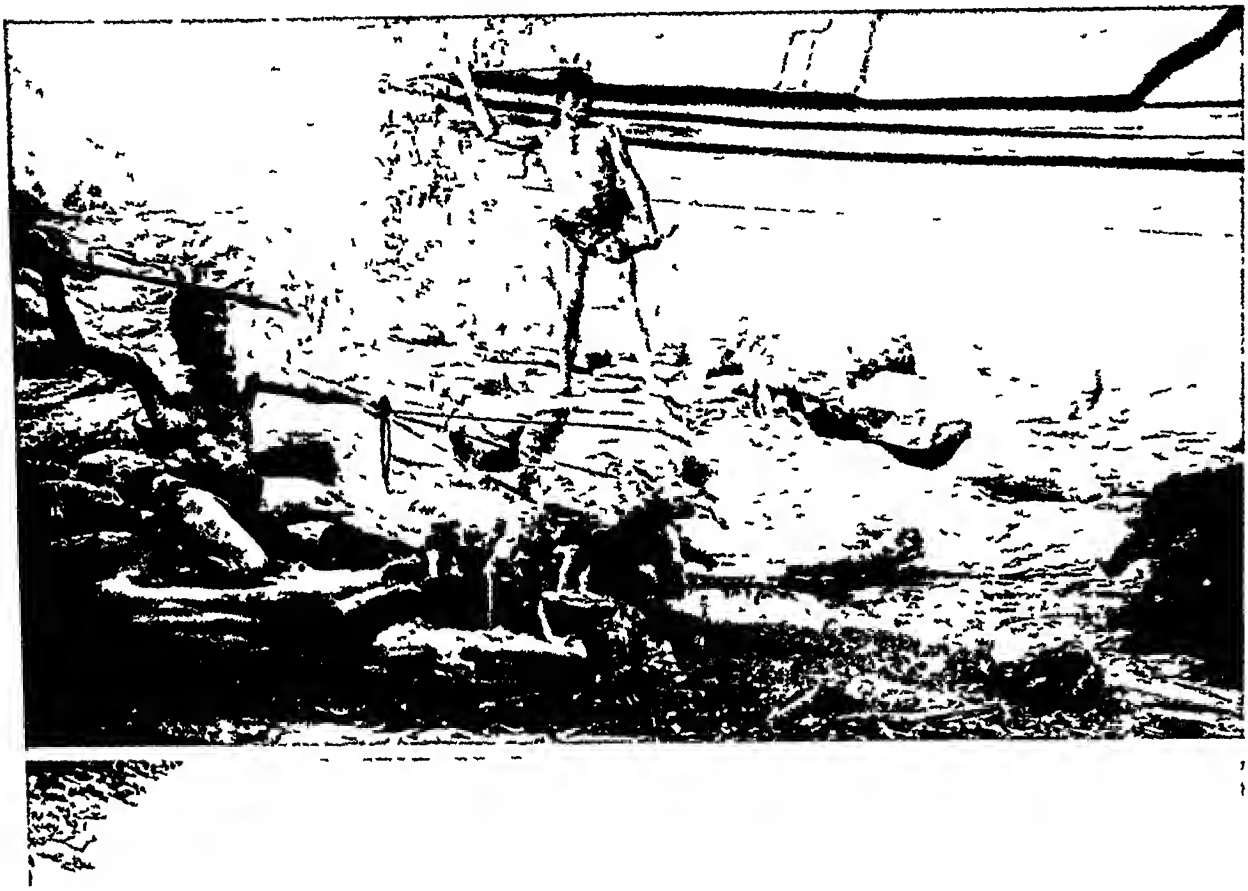
ON the banks of the river Marne in France about 250 000 years ago there lived, so students of Man's development tell us, a race of people who looked very much like the figures in the upper picture on the preceding page Similar types of men were living at the time in other parts of Europe and in Africa and Asia, but, because the first discovered remains of the race were near the town of Chelles, they are called the Chellean people (see map) Popularly they are nicknamed "Dawn Men," or "the First Europeans" We know little about them except that they made roughly shaped hand axes and scrapers of stone, fashioned by chipping as we see one of the men doing in the picture Almost certainly they knew how to make fire for roasting meat The climate of northern France at that period was warm, suited to the elephant and hippopotamus, as well as to the elk and the wolf We imagine that these Chelleans wore little or no clothing and that they slept in the shelter of rocks or trees No remains have been found of dwellings of any type that date back so far

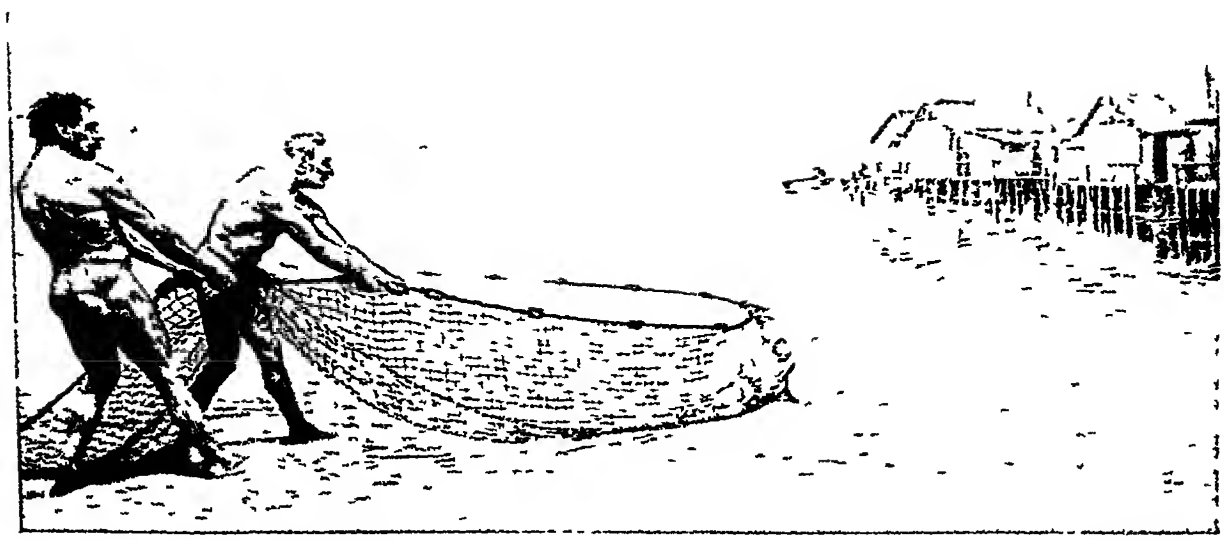
The lower picture on the preceding page brings us much nearer our own time and to a far richer store of established facts For it takes us into the home of a cave dweller of about 35 000 years ago—the Aurignacian period, named from the town of Aurignac near which important remains of the cave dwellers' culture were discovered The Cro Magnons named from a spot farther north, were his relatives (*See* Cave dwellers)

These men of the Aurignacian period were, so far as we know, the first artists Our picture exactly reproduces drawings and paintings found on the walls of a French cave A prehistoric artist is shown at work on one of those strange symbols, the purpose of which is hard to guess He is blowing red ochre dust through a bone tube to form on the wall an outline of his left hand Many of the outlines already made, evidently from other hands than his, have missing fingers Do these mutilations represent some primitive religious ritual? No one knows for certain

The animals drawn on the wall are chiefly buffaloes and elephants or mammoths They show that these cave artists had keen eyes for proportion and movement and skilful hands for reproducing, with a few simple lines, what they saw

THE TAMERS OF ANIMALS & THE LAKE-DWELLERS





Direct colour photographs of museum groups — *See text overleaf*

The photographs in this and the plate facing page 2636 were made by permission of the Field Museum of Natural History Chicago The museum exhibits represented are of the diorama type consisting of life-size figures and other objects in a foreground which blends imperceptibly into a painted background The general plan of the exhibits was worked out by Henry Field and Berthold Laufer of the museum s scientific staff, with the co-operation of the Abbe Henri Breuil of the College de France The figures are the work of Frederick Blaschke, sculptor based on descriptions and measurements supplied by the Abbe Breuil Sir Arthur Keith, and Sir Grafton Elliot Smith Backgrounds by Charles A Corwin Colour photography by Lee Saylor

THE TAMERS OF ANIMALS AND THE LAKE-DWELLERS

SOME 12,000 years ago in western Europe there appeared groups of people far inferior to the cave dwellers in art and perhaps in general intelligence, but superior to them in warfare and hunting. These were the Azilians pictured at the top of the plate overleaf. The name was given them because remains of the culture were first found at Mas d'Azil in southern France (see map facing preceding page).

Perhaps their chief advantage lay in the fact that they or their ancestors had begun to tame animals and put them to work. The picture shows us two Azilian hunters who, by the aid of their dogs, have cornered a wild boar and are about to kill it with their flint tipped spears. For fishing these people fashioned barbed harpoons, and they made necklaces and other decorations of shells and the teeth of deer.

The advent of the Azilians marked the end of the Old Stone Age in Europe. It is impossible to say whether these people exterminated one another in warfare or fell under the domination of more intelligent races with whom they settled down and by whom they were absorbed. But they seem to have disappeared by the time the culture of the New Stone Age was taking shape in Europe.

Most interesting of the people of this New Stone Age are those we call lake dwellers. Numerous remains of their settlements are found along the borders of the Swiss lakes. The lower picture in the preceding page shows a reconstruction of one of their villages on Lake Neuchâtel (see map). The wooden piles on which the houses rested have been preserved under water and the lake bottom has yielded up countless other relics.

With the lake dwellers we take a tremendous forward step in the story of primitive men. They far excelled the earlier types in the crafts and in what we would today call domestic science. Most important of all, they had learned the advantages of co operation by groups of families under a common leadership, the beginnings of settled social organization.

As the picture shows, these people were fishermen. They used nets made from linen cords, fish spears, and hooks. They possessed dugout canoes. They knew how to weave cloth. They raised cattle and cereals. They made household implements of pottery, stone, bone, and copper, and on the very threshold of the historic period, they had learned how to get and use iron.

Their dwellings were one room structures resting on platforms made of small logs or rough planks covered with earth. The walls were fashioned of woven twigs and rushes and plastered with clay. Fires burned on stone hearths in the centre of the floor, the smoke escaping through holes in the thatched roofs. The houses in each group were connected to one another, and also to the mainland, by small railed bridges.

It is believed that these people built their villages out over the water to protect themselves in their peaceful pursuits from their less civilized neighbours, who may have been wandering hunters. Remains of more than fifty such settlements have been counted on Lake Neuchâtel alone.

To face page

The men of the Late Stone Age were represented by the Solutreans and Magdalenians, whose stone implements were rubbed smooth and sometimes polished While they, too, were hunters, they also herded cattle, and cultivated plants for food Most students of the subject agree that the human race originated in central Asia, and spread from there over the world

Archaeologists divide human history into phases, which are really stages of material culture, but are sometimes conceived of as chronological ages First, there was the so-called Eolithic Age, or dawn of stone implements These "eoliths" are assumed to be either Man's first crude attempts at tool making or merely pieces of stone of convenient size which show the effect of use It is difficult to determine whether the eoliths are really artifacts, or were caused by erosion, rock pressure, the pounding of animal hoofs, or other natural forces

The oldest undoubted human implements are known as palaeoliths, and the men who produced them belonged to the Palaeolithic (Old Stone) Age The older palaeoliths are crude in workmanship and are mostly stones of flint, quartz, etc, shaped chiefly as scrapers or knives by flaking with a hammer-stone The later palaeoliths show an improved handicraft Flaking was done by pressure instead of by blows, and the implements have a neater and more uniform appearance The men of the later Palaeolithic Age likewise produced tools of bone, ivory, and horn The duration of this period is generally estimated at several hundred thousand years, because palaeoliths are found at different depths in the earth, but always in the same order, showing a gradation of cultures from primitive implements to more elaborate, even artistic, craftsmanship

Next came the Mesolithic Age, a phase of transition between the Palaeolithic and the coming of the Neolithic (New Stone) Age In general it is marked by a decline in stone workmanship but is characterized by pebbles painted with simple designs which may be the beginnings of an alphabet, or more probably magical or religious symbols

The Neolithic Age was a period of more skilfully fashioned artifacts, when the implements were often polished and made for a wider range of uses The people of this age also possessed pottery, and used the bow and arrow The domestication of animals, the cultivation of plants, the invention of the wheel, and the weaving of linen are other revolutionary advances during Neolithic times

It is estimated that in Egypt this age may date back 20,000 years, in Crete 14,000 years, and in western Europe some 7,000 or 8,000 years

HUNTERS OF THE OLD STONE AGE

Here you see reproduced from a drawing by A Forestier in the London Museum, what the hunters of the Old Stone Age (Palaeolithic) looked like In the background is a man chipping flints, while his companion, clothed in skins, has a spear, a great club, and a flint hand-axe

In the beginning, so scientists say, Primitive Man wandered through tropical forests picking up the food provided by Nature nuts, roots, and fruit, or occasional small animals Some authorities hold, on the basis of anatomical peculiarities, that Man's remotest ancestors lived in trees, as do some of the apes and monkeys today They believe, for example, that the ability of a human

baby to grip things with its toes is a relic of such an arboreal stage of existence

Primitive men were at first without tools or weapons except sticks, stones, and bones, used as they found them They soon learned, however, how to modify these for various purposes They wore little or no clothing, clothes were not needed in a warm climate At night they found shelter in a tree or cave, but were ever at the mercy of the huge beasts of prey

Even before men were able to produce fire at will, they doubtless made use of it They must have noticed that when the forest was set ablaze by lightning, even the strongest of animals were frightened away, and that this dreadful fire also provided warmth on cool nights They may have collected some of the burning sticks to carry about with them and so learned to keep the flame alive

The savage who noticed that by pounding rocks together sparks could be made to ignite dry powdered wood, or he who first started a fire by rubbing dry sticks, made a more momentous discovery No beast has ever learned how to make fire With this invention, Man made his first great step towards civilization Fire gave him a weapon of defence, a source of comfort, and a means of cooking food

Little is known, but much is surmised, about these early stages of progress Relics of this period are few But when Man took refuge in caves and rock shelters, and his descendants continued to use the same caves over a period of thousands of years, he unconsciously left his records, chapter by chapter, in the accumulated deposits of rubbish, bones, tools, etc

WHEN MAN FIRST LEARNED TO CARVE

The earliest carvings made by Man were for use and not art only, and bone or reindeer horns were the materials used The man on the left of this illustration carries a harpoon and the horns of a reindeer, while the one on the right shows him a "shaft-straightener" that he has just completed

From the drawing by A Forestier in the London Museum

The inhabitants of western Europe at the beginning of the fourth glacial period were a rude but not a brutish people They were acquainted with the use of fire They quarried flint and trimmed the pieces to make implements of various sorts They could kill the smaller animals with their axes, spears, and clubs, and perhaps hunted some of the larger creatures with traps and pitfalls The dried animal skins were used for clothing, some of the skulls were made into bowls or vessels, the long bones were split and the marrow eaten

The men of this period already had a rudimentary social life The family group was ruled by the "Old Man," the oldest adult male, and only women and children were permitted to be with him He reigned until some younger male drove him out or killed him That these people had certain religious ideas is attested by skeletons found in their burial places, interred with implements and food, indicating ceremonial burial and belief in a spirit world

During the period called the Middle Stone Age men equipped themselves with newer and keener tools They fitted barbed ivory points to their wooden spears and invented a throwing stick to hook round the butt of the spear so as to discharge the weapon with greater speed and power They also invented the bow and arrow

Now Man was more than a match for the savage cave-bear, the mammoth, and sabre-toothed tiger Now, too, he was assured of abundant food

MAN'S EARLY ATTEMPTS AT PICTORIAL ART

Some prehistoric men were artists whose work achieved a very high standard. Remarkable examples of these early paintings have been found in the Altamira cave in Cantabria, in the north of Spain, and in the Font-de-Gaume cave in the Dordogne, in the south of France. The running boar, the hind and the studies of bison beside them are in the Altamira cave, while the two reindeer (bottom) are at Font-de-Gaume

From Abbé Breuil, 'Caverne d'Altamira' and 'Caverne de Font de Gaume'

2

CAVE-MEN ARTISTS AT WORK

IN this reconstruction (by A. Forestier, in the London Museum), an impression is given of how those primitive men worked who did the glorious cave paintings that are reproduced overleaf. In the foreground a man is grinding the materials, and by his side you see the reindeer shoulder blade that does duty as a palette. Behind him is another of the tribe, standing up as he works on the wall, outlining one of those great bison that have since become world famous as the earliest masterpieces of Man's art. The artists worked by the light of crude lamps, burning oil—probably animal fat—placed in a bowl of clay. *Red, yellow, and shades of brown* were the colours used, and these were obtained from the soil itself, powdered down and mixed with water. The black outlines were done in charcoal often assisted by engraved lines made with some crude implement.

MAN'S EARLIEST ATTEMPTS AT WORKING METALS

Copper was first successfully worked by mankind about 5,000 years ago, and this illustration shows the methods of mining and smelting. The ore was first broken from an out-cropping seam with stone hammers (top right) and then pounded in a mortar. The pounded ore was melted in a clay furnace (bottom right), and the molten metal was then conveyed in ladles to moulds of clay, stone and metal (left). Broken moulds and finished axes may be seen in the left foreground.

From a diorama in the London Museum

The women learned to scrape and cure skins until they were soft, and to sew them with bone and ivory needles into more serviceable garments. The men even made bone whistles. An astonishing fact is that these early hunters could carve and draw, and even paint with skill.

One of the most important innovations of the Late Stone Age was the invention of pottery. This great discovery enabled men to cross the gap between savagery and what we call barbarism. For with pottery came the means of boiling food. This added to men's bill of fare, and the simmering pot became the community centre. It was also discovered that stone tools might be ground and thus become sharp axes, chisels, and knives. With these men could fashion more comfortable dwellings, boats, and wooden utensils.

The earliest settlements of the Late Stone Age are to be found in Denmark. Here, along the sea-coast, prehistoric men built their wattle huts, erected on a foundation of stone and constructed of interwoven reeds plastered with clay. In rude boats they ventured out from shore to gather oysters and other shellfish, and on land hunted the wild boar and the wild bull. After feasting by the fireside they would toss aside the shells, bones, and other refuse, which accumulated into extensive heaps. From these "kitchen-middens" archaeologists have recovered thousands of stone tools, weapons, fragments of pottery, and other relics of the life of these early people.

The Late Stone Age people of Switzerland were even farther advanced than the prehistoric Norsemen. To make themselves safe from attack, they erected comfortable wooden dwellings out over the water of the Swiss lakes (*See* Lake Dwellers). Quantities of wooden furniture, implements, and pottery have been recovered from the sites of these "pile-dwellings."

With agriculture and the domestication of animals there arose two methods of living. Some of the people settled in one place, devoting themselves to agriculture, while others took care of the animals, following the pasture according to the season. The shepherds might go to the north side of the mountains in the summer and to the south in the winter, living on milk and meat from their herds. Such wandering tribes we call nomads. They were very hardy and often made raids on the farmers. The conflict between nomads and townsmen, begun ages ago, recurs periodically through human history.

Besides Swiss lake dwellers, there existed elsewhere in Europe other settled communities, the remains of some of which are still traceable These people lived in fortified towns and near by erected impressive tombs, built of enormous blocks of rough stone (megaliths) It must have required organization and leadership to raise the mighty megaliths at Stonehenge or drive in the 50,000 piles at Wangen, Switzerland

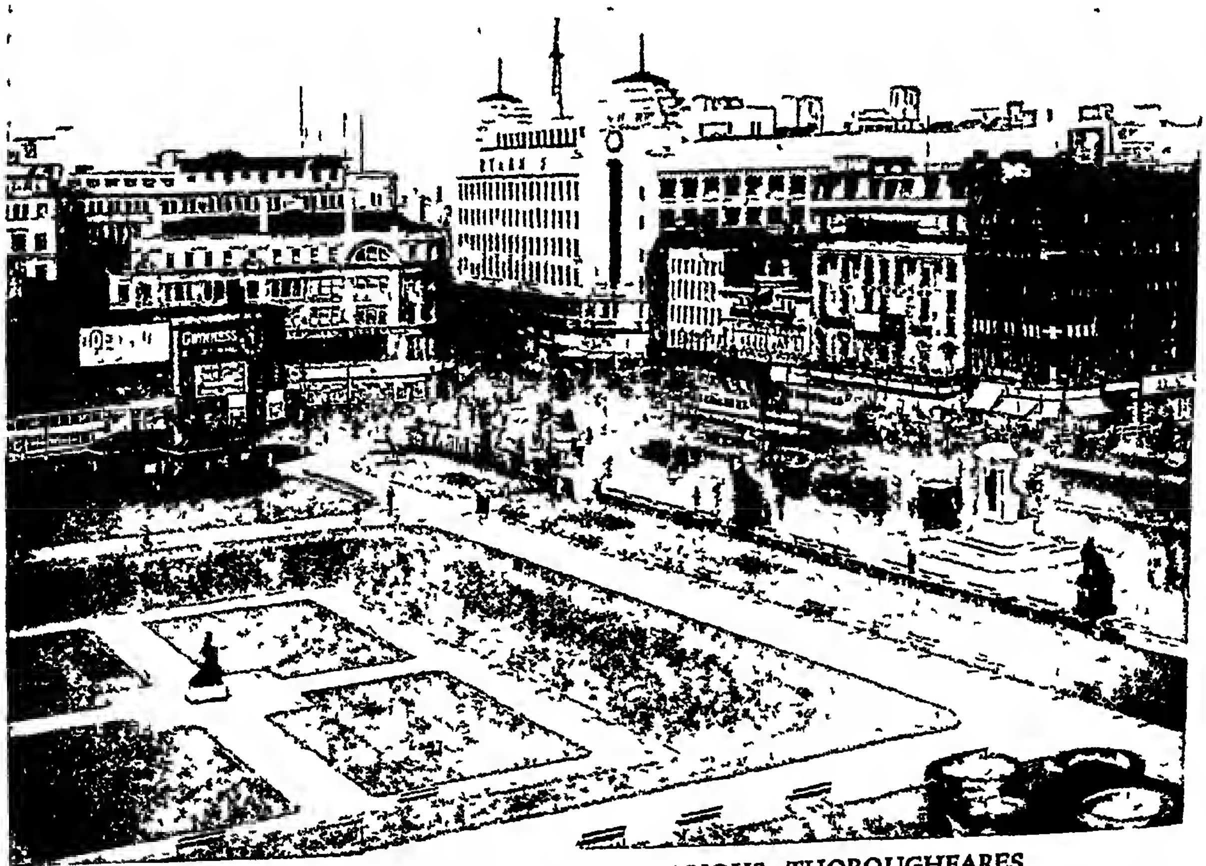
After the Stone Ages came the Age of Metal Copper implements and ornaments were apparently the first metal objects to be made The Age of Copper began in Egypt about 5,000 years ago This was followed some 1,500 years later by the Age of Bronze Iron came into use in Europe during the thousand years before the beginning of the Christian era

Man, Isle of In the Irish Sea, nearly equidistant from England, Ireland, and Scotland, lies the little Isle of Man (or *Mona*), with an area of only 227 square miles

Over half the land is cultivated Fishing is important, and mining for zinc and silver is carried on The summer tourist trade is the island's richest industry, however, and from May to September millions of holiday-makers from all over Great Britain and Ireland, but especially from Lancashire, find their relaxation, pleasure, and annual "tonic" on its shores The principal town is Douglas, the capital (population, 19,000), a favourite watering-place on the coast Snaefell (2,034 ft) is the highest point Although a part of the United Kingdom of Great Britain and Northern Ireland, Man has "home rule" under a centuries-old constitution The legislature, or Tynwald, includes a Governor and Council and a representative assembly called the House of Keys The language is Manx The island is known for its tailless cats The population is about 49,000

Manchester. Many centuries ago Manchester was noted, as it still is, for its textile manufactures At first it specialized in woollen cloth, which was produced by Flemish weavers who settled there Now it is the world centre for the cotton trade, having grown with enormous rapidity since the great inventions that revolutionized the cotton industry in the 18th century The factories, however, are not so much found in the city itself as in the outskirts and ring of neighbouring towns

This Lancashire district is the most populous industrial section in England, owing to the moist climate which makes it peculiarly adapted



ONE OF MANCHESTER'S MOST FAMOUS THOROUGHFARES

Through the heart of the city of Manchester runs Piccadilly, a great shopping centre This photograph shows in the foreground the site of the old Manchester Infirmary, now laid out as public gardens On the right is the Queen Victoria Memorial, and to the left of it is a statue of Sir Robert Peel The building with the clock is the Rylands building, and on the lattice tower above it is a searchlight, the beams of which guide airmen to the Manchester airport

to cotton spinning, and the rich coal fields which supply the innumerable factories Since 1894 Manchester has been not only the trading centre for this region, but, with the opening of the great Ship Canal, a seaport as well This canal, which extends to the mouth of the river Mersey, a distance of 35 miles, has enormously increased Manchester's industrial and commercial importance

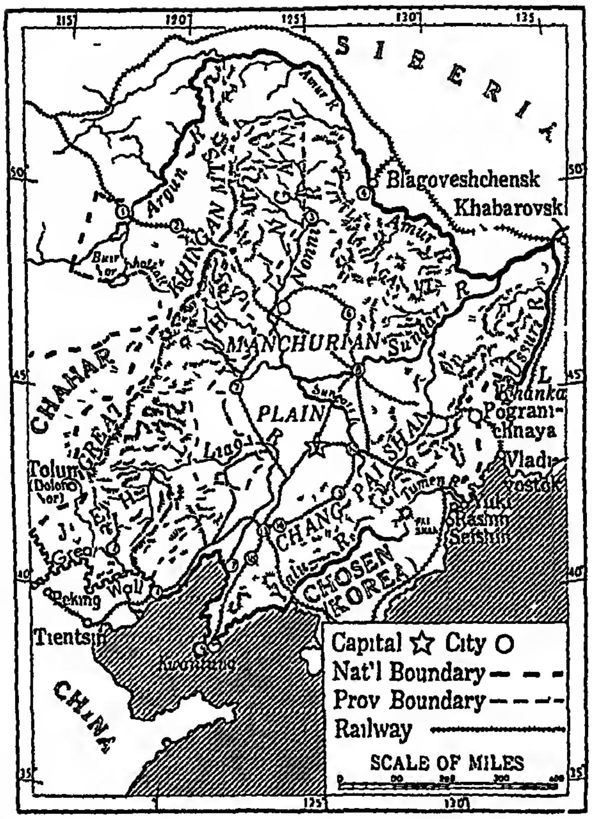
Manchester has a good park system, and some very attractive residences are found near its boundaries There are several splendid public buildings The Town Hall is one of the most magnificent in England, the Exchange is a fine building in the classic style, the Assize Court is a beautiful example of Gothic architecture, and the Central Library is a fine modern building The Cathedral, built in the 15th century, is near the centre of the city Manchester is also the seat of a university (Owens College) Another notable building is the Free Trade Hall, providing accommodation for about 5,000 people It was built in 1856 to commemorate political victories in connexion with the Anti-Corn Law League and kindred movements

The John Rylands Library, in Deansgate, has a wonderful collection of books, including the famous Althorp collection The Chetham Hospital and Library was founded and endowed by Humphrey Chetham in the 17th century Manchester's principal newspaper, "The Manchester Guardian," exercises a nation-wide influence Another important side of Manchester life is the Halle concerts

Manchester, the Mancunium of the Romans, is situated on the river Irwell (on the other side of which is Salford) and its tributaries the Medlock and the Irk It was originally a Roman fort The city was the headquarters of the so-called Manchester School of politico-economists, whose influence began to be felt about 1845

Besides the textile industry, which includes spinning, weaving, printing, bleaching, and dyeing, machinery and chemicals are manufactured in Manchester for the cotton mills, with many miscellaneous small wares The population numbers about 766,000

Manchukuo. (Pron man-chōō-kwō') (MANCHURIA) The land of the Manchus, which lies to the north-east of the Great Wall of China, has long been a source of trouble for China The fierce Manchus raided Chinese farmers for ages, and in 1644 a Manchu emperor seized the throne of China His line reigned until the Chinese republic was formed under Yuan Shih-Kai's presidency in 1912



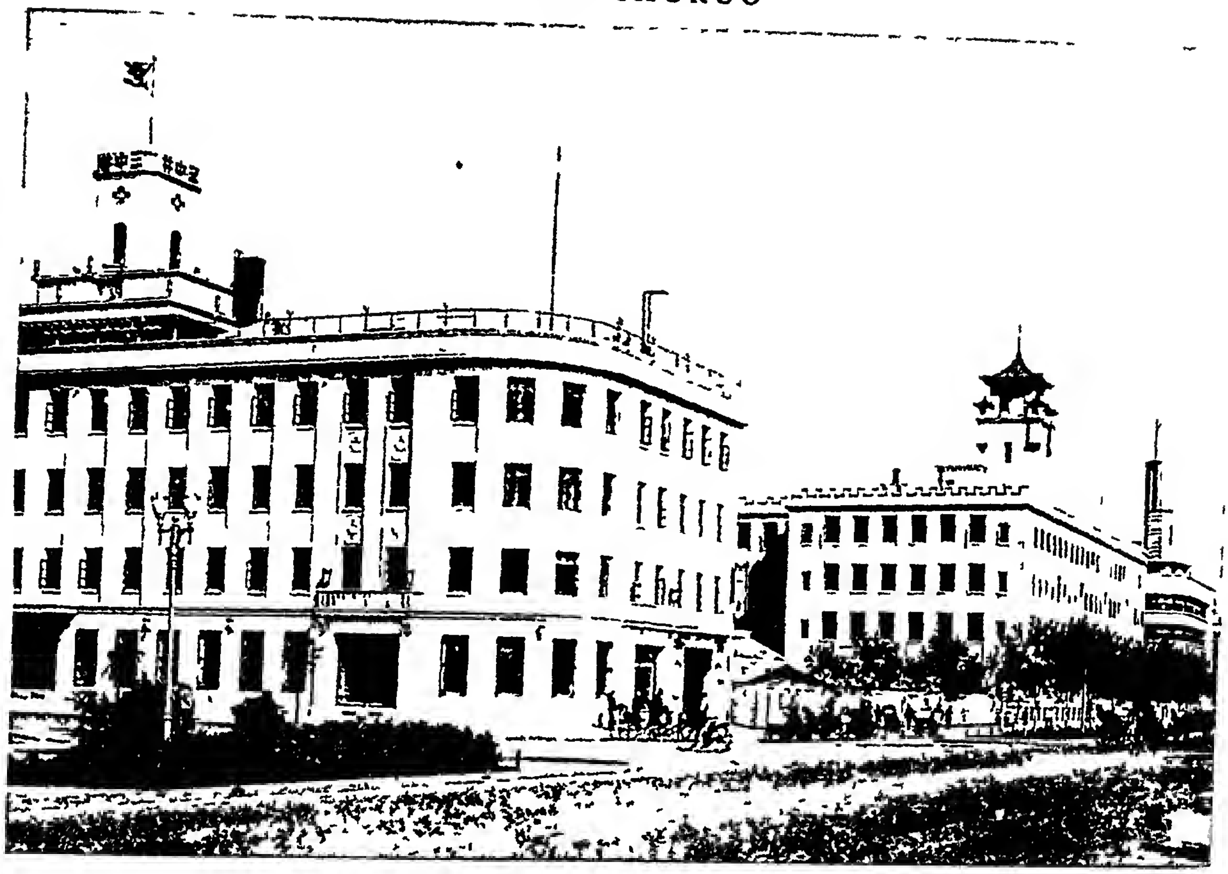
MANCHUKUO ON THE MAP

Manchukuo is a political state which includes the great Manchurian Plain, shown in the centre of this map, and mountain ranges to the east and north-east The plain is nowhere more than 1,000 feet above sea level In addition, Manchukuo includes considerable Mongol territory, which corresponds roughly to the provinces of Jehol and Hsingan The cities indicated with numbers on the map from top to bottom are 1, Manchouli, 2, Hailar, 3, Mergen 4, Aigun, 5, Tsitsihar, 6, Hailun, 7, Taonan, 8, Harbin, 9, Hsinking (Changchun), the capital, 10, Kirin, 11, Suifenho, called Pogranichnaya in Russian, 12, Jehol City (Chengteh), 13, Mukden, 14, Fushun, 15, Hailung 16, Shanhaikwan (Lin-yu), 17, Yingkow (Newchwang), 18 Anshan, 19 Port Arthur, 20, Dairen

Until 1878 Chinese were barred from Manchuria (as the land was styled before the Japanese occupation) They drifted in slowly at first, but after the World War they began swarming in at a rate of about a million a year Now there are probably 27,000,000 of them in a population of approximately 36,933,000 China Proper, exclusive of Manchukuo, groans under a crowded population of more than 270 persons per square mile, while there are about 70 to the square mile in Manchukuo That is why the Chinese poured into this land of promise Manchukuo has been to China what the Dominions and Colonies were to Britain The climate, burning hot in the short summer, crisply cold in winter, is healthful

SOME FACTS ABOUT MANCHUKUO

Area—Estimated at 503,000 sq m population 36,933,000
Physical Features—The Manchurian Plain, 137,000 sq m, bordered by mountains Rivers Amur, Sungari Yalu
Principal Products—Soya and other beans, kaoling, millet, wheat, maize rice, cotton, tobacco timber, furs, hides coal iron, salt, oil gold, lead copper, manganese
Chief Cities—Mukden (739 000), Harbin (463,000), Dairen (in Kwantung Province 500 000), Hsinking (capital, 355,000)



Keystone

NEW BUILDINGS IN MANCHUKUO'S NEW CAPITAL

In 1933, after Manchukuo had separated from China, Hsinking became the capital instead of Mukden It was at that time a squalid and ramshackle city, but since the country passed under the control of Japan great changes have been made. Modern concrete buildings have been erected, and new and wide streets constructed This photograph shows Tatung Avenue, one of the great new boulevards lined with very modern buildings That on the left is a department store

Manchukuo is one of the world's most fertile districts Some 82,000,000 acres of its 500,000 square miles are under cultivation Soya beans are the chief crop Kaoliang (a cereal), wheat, maize, millet, sugar beets, rice, and tobacco are also raised Cattle, pigs, sheep, and horses abound There are 30,000,000 acres of forests, and mines of coal, iron, lead, asbestos, silver, and gold Flour and bean-oil mills, sugar refineries, soap-works, saw-mills, tanneries, and glass factories prepare the raw materials for market

Close on 4,000 miles of railways—nearly as much as in all China—carry Manchukuo's trade, which is half as large as China's, though China has 14 times as many people The river Sungari and its branches serve as feeders to the railways

The principal city is Mukden, the former capital, with a population of 739,000 Hsinking (previously Changchun) has been the capital since 1932 Its population is in the region of 355,000 Harbin, a railway centre, has about 463,000

Railways Across the Plains

The railways which have brought prosperity to Manchukuo have also brought it the woe of war Manchukuo is one of the "dynamite spots" of the world, with Russia and Japan in a constant struggle to possess the riches of the territory Russia built the Chinese Eastern Railway from Manchouli on the western border to Pogranichnaya on the east, under a charter of December 1896 In 1898 Russia secured a lease on the Kwantung Peninsula, and built a spur from Harbin, on the Chinese Eastern line, south to Dalny (now Dairen), the best natural harbour in Manchuria, and to Port Arthur

Japan wrested the Kwantung lease and the South Manchurian Railway from Russia in the war of 1904–05 (*see* Russo-Japanese War) and soon built branches linking it with Korea Practically all the commerce along the South Manchurian line is controlled by Japanese, and Japan shares more than half of all Manchukuo's trade Modern Manchukuo offers Japan a wonderful outlet for its manufactures, and provides coal and iron for Japanese industries

In 1931–32 Japan, declaring that China's inability to suppress banditry in Manchuria had become intolerable, sent armies to seize control of the region and also the Mongolian province of Jehol between Manchuria and the Great Wall In February 1932, after an intensive campaign, Japan announced that it would recognize an independent state of Manchukuo, which would contain Manchuria and Jehol, with an area of more than 500,000 square miles—almost twice as large as Japan Henry Pu-yi, who had

abdicated as emperor of China in 1912, was named ruler, and enthroned as Emperor Kang Teh in 1934, with the Japanese in virtual control Russia's chief objection was met by Manchukuo's purchase of the Chinese Eastern line in 1935

Manganese. This metallic element is essential as an alloy for steel and copper, for it increases their hardness, tenacity, and elasticity in the gearings and wearing parts of heavy machinery, ordnance pieces, and armour plate

Manganese resembles iron, but it is not magnetic It has a greyish lustre, faintly tinged with red, and rusts rapidly in moist air Pure manganese is only a chemical curiosity "Spiegeleisen" is an iron with about 12 per cent manganese, and is made in a special high-temperature furnace, "ferro-manganese" has about 70 per cent of manganese and about 5 per cent of carbon Both are used as steel alloys

Some salts derived from manganese are used in chemistry, medicine, and the arts Because of their readiness to part with their oxygen, potassium and sodium permanganate are highly esteemed antiseptics and disinfectants, the liberated oxygen being a potent killer of germs

Russia is the greatest producer of manganese, India and Czechoslovakia ranking next

Mango. "The mango is the Pride of the Garden, the choicest fruit of Hindustan," wrote a poet of the 14th century, although he was praising the wild mango (*Mangifera indica*), whose sour and fibrous fruit tastes of turpentine This same fruit has acquired a blending of pleasant flavours and has grown sweet and mellow in the hands of the fruit-growers

Hindustan and Malaya claim the mango as a native, but the tree is cultivated throughout the tropics and subtropics The mangoes now grown in Florida represent many varieties, they weigh from six ounces to more than a pound, and vary in colour from green and yellow to pink and crimson A ripe mango is eaten like a melon, and the unripe fruit makes delicious mango pie and is used for pickles and preserves, it is in the last connexion that it is best known to us The tall tree, 40 to 80 feet high, with spreading branches and large green leaves, makes a beautiful shade tree The mango is a member of the order *Anacardiaceae*, and is a cousin of the notorious poison ivy and the beautiful pepper tree

Mangrove. Dense mangrove thickets, growing in salt water along tropical shores, set up impenetrable barriers between the sea and mainland The numerous roots of these trees form nets that become choked with mud and debris In this way mangroves build marshy areas into substantial soil, and thus many acres have been added to the land, especially in parts such as Florida and Malaya

Because of its peculiar home, the mangrove depends on special structures to ensure life and reproduction Aerial roots project out of the water to bring in oxygen to the plant, and the seeds, which germinate while still on the tree, do not drop until they have roots three or four feet long to anchor them in the mud Roots grow out of the trunk and branches and strike into the mud, so that the tree seems to be supported by a complicated series of artificial loops and stakes

The mangrove grows about 20 feet high and has heavy close-grained wood The bark is used for tanning leather The scientific name of the commonest species is *Rhizophora Mangle* The fruit is sweet and frequently eaten

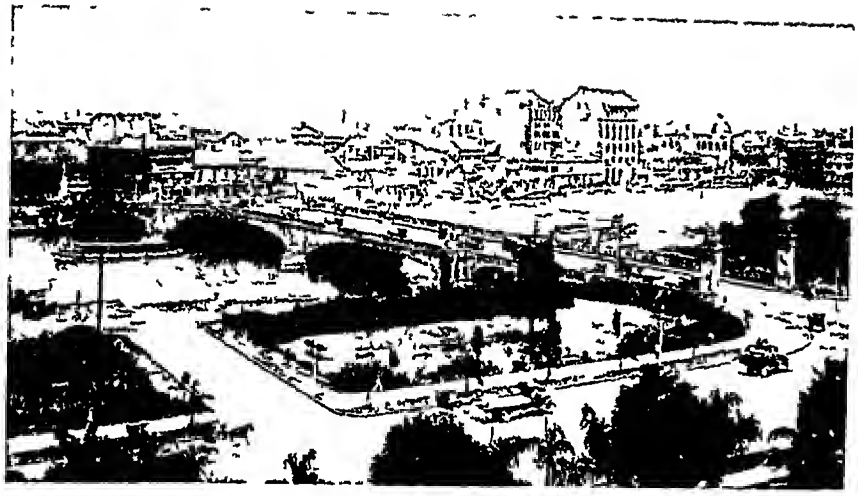
Manila, PHILIPPINE ISLANDS It is noonday, the hour of siesta, in the sweltering, stinging heat of the tropics Only natives and noisy American street-cars are abroad in the narrow streets of Manila Shops are closed From the old walled city, where Fort Santiago commands the bay, to the farthest suburb beyond the river, business has been suspended, and people have gone for two hours' rest into the dim gloom of rambling Spanish two-storeyed houses

At two o'clock the town wakes up again The busy Pasig is choked with long native

FLOURISHING MANGO IN FRUIT

Although it is a native of India and Malaya, the mango is successfully grown in many other parts of the tropics and sub-tropics, and here is a fine example in full fruit growing in Brisbane Queensland The tree has been vastly improved by cultivation

Courtesy of Queensland Govt



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MANILA'S GREAT NEW BRIDGE

Manila, the capital of the Philippines, stands on the Pasig river. The old walled Spanish city is connected with the new city by the bridge seen in the photograph. Across the bridge can be seen a part of the new city and its business quarter, with warehouses lining the river. Here the islands' products are stored ready for export

craft, steam-launches, and coasting boats. Along the stone embankments are warehouses where sugar, tobacco, copra (dried coconut meat), and mountains of brown hemp await transfer to the holds of ocean liners that lie at anchor outside in beautiful Manila Bay, encircled by an amphitheatre of green hills which stretch round past Cavite (the principal coaling station of the United States in Asiatic waters) to the narrow entrance and two fortified islands, Cavallo and Corregidor. After sunset all Manila sits about on benches or in carriages in the Luneta, the fashionable promenade along the bay.

Manila was a native village when the Spaniards took it over in 1571. Today it sprawls over about twenty square miles on both sides of the Pasig. Its medieval appearance has been modified by the vigorous measures which have been taken to improve the harbour, streets, sanitation, and water supply. There are now an excellent school system and a flourishing university. Manila has long been subject to earthquakes. In the serious shock of 1862 many lives were lost and great damage was done to buildings and other property. Its population is about 361,000.

The EMPIRE'S GRANARY *in* CANADA

Unbroken by hills or deep valleys, the grain-land region of Manitoba stretches for five hundred miles across the heart of Canada—field after field of waving corn, as far as the eye can see

Manitoba, CANADA. The Indians of the prairies believed that the region now included in the province of Manitoba was especially favoured by the Great Spirit, and that around the "narrows" of Lake Manitoba his voice might be heard. Therefore they called the region "Manito-Waban" (Great Spirit's Narrows). The inhabitants of today agree with the red men in regarding the province as "God's Country," and for proof they point to the broad prairies of the south-west, covered with fields of grain, which form one of the world's greatest grain regions.

Extent.—North to south, 760 miles; east to west, 495 miles. Area, 246,572 square miles, 27,000 of which are water. Population, about 700,000.
Physical Features.—Great prairies in south-west and south, with broken and hilly land of the Laurentian country in the north and east. Higher elevations, Riding and Duck mountains. Lakes Winnipeg, Winnipegosis, Manitoba, and Dauphin, and numerous small lakes. Principal rivers: Red River of the North, Assiniboine, Saskatchewan, and Winnipeg, draining into Lake Winnipeg; Nelson, draining Lake Winnipeg into Hudson Bay; Churchill and Hayes, also emptying into Hudson Bay.
Products.—Wheat, oats, barley, rye, potatoes, flax, hay; live-stock and dairy produce; building materials (brick, cement, stone, gypsum); lumber; fur and game, fish.
Principal Cities.—Winnipeg (capital, 217,000), Brandon, St Boniface.

On the great farms, most of them from 160 to 640 acres, teams of four, six or eight horses and powerful tractors plough and harrow the soil and cut the grain at a great speed.

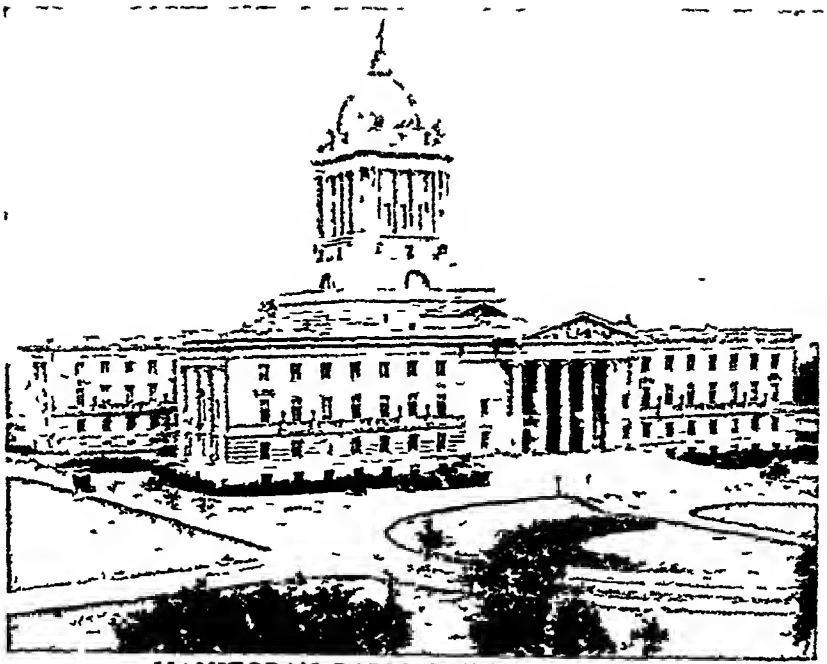
Occasionally the landscape is broken by lakes or a bit of marsh-land with little ponds of still water. The largest body of water is Lake Winnipeg (area, 8,555 square miles), though it is nowhere more than seventy feet deep.

The province enjoys an invigorating climate, though variations are sudden and of great range. The winters are severe, but the springs are early, and advance rapidly to summer heat. An April that begins with wintry weather may be hot before it is succeeded by May. The great heat of midsummer causes the grain to ripen quickly, and there is little rain at harvest time, so that the crops are gathered without dread of wetting. Occasional early frosts rarely affect the yield.

The soil and climate are adapted not only to producing a great quantity of wheat—as much as 45,000,000 bushels a year—but also to growing a fine quality, so that "Manitoba hard" has become the standard for the highest

grade of wheat sold Cattle and pig raising, dairying, and bee keeping are fast becoming more important

The northern part of Manitoba is too cold for agriculture, but it is in this section that the hunter and the trapper find the fur-bearing animals—the mink, musk-rats, martens, foxes, and others—whose skins command such a high price Here also, and in the western part of the province, are numerous forests of spruce, which make lumbering one of the important industries Another source of wealth which is being developed is the rich deposits of gold and copper, zinc, and silver The numerous lakes in Manitoba furnish large catches of excellent fish, and in 1935 the quantity taken was over 20 million pounds, valued at £194,000



MANITOBA'S PARLIAMENT BUILDINGS

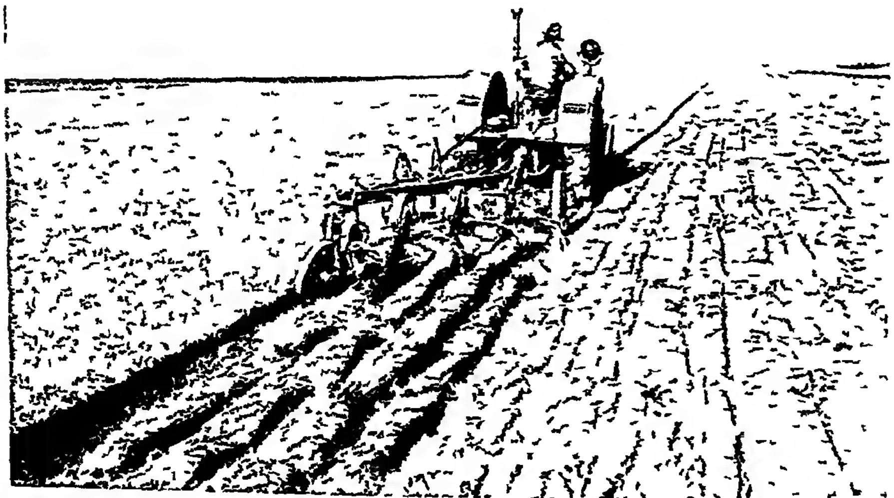
At Winnipeg, the capital of the province of Manitoba, are the provincial legislative buildings, seen above These were completed in 1923, replacing an older building on the same site, near the Assiniboine river They form an imposing pile in the best modern style, and are surrounded by well laid-out grounds

Photo Canadian National Rlys

These products and the wheat from the south all find their way to Winnipeg, the capital and the principal city This is the "neck of the funnel" for east and west traffic, and this fact has made the city a great railway centre

The history of Manitoba is the history of the Hudson's Bay and North-West companies and of the Canadian Pacific Railway Until 1870 the land was owned and the people governed by the great fur-trading company The only important settlement in the region was the Red River Settlement, founded in 1812 by the Earl of Selkirk Apart from the Indians and half-breeds, most of the men were Scots

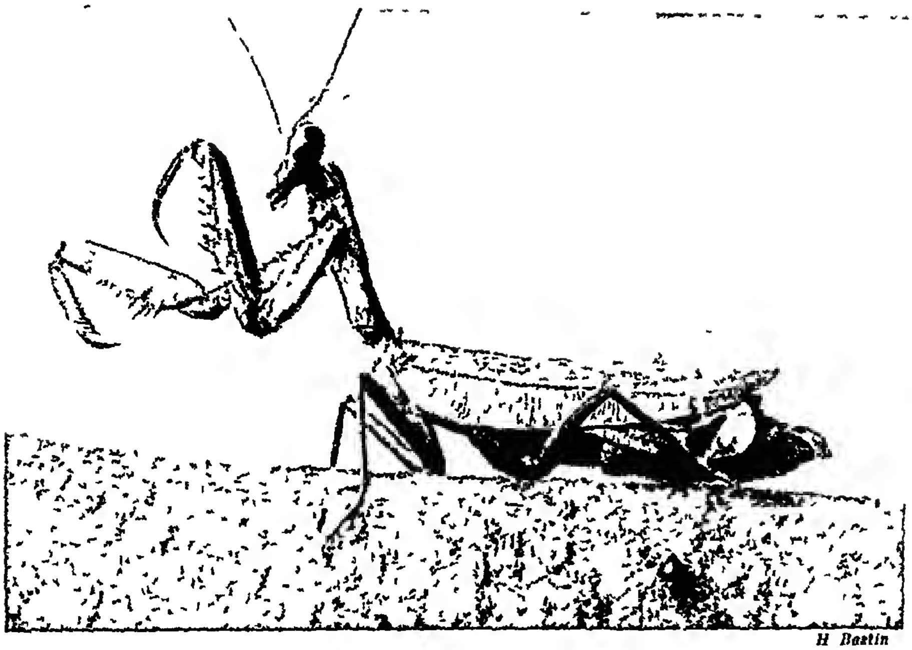
In 1870 the Hudson's Bay Company transferred its rights, on conditions, to the recently formed Dominion of Canada The French *metis*, or half-breeds, feared that their language and religion would not be respected, and there followed the Red River Rebellion The uprising was suppressed, but the problems which caused it have not been finally solved It was the building of the great Canadian



PLOUGHING THE PRAIRIE FOR GRAIN

Western Canada is one of the great granaries of the world, and could, with intensive production be made to supply the needs of practically the whole Empire The chief wheat-growing province is Manitoba where this picture was taken of a motor-tractor ploughing a furrow that looks a mile long and where later in the year, tall golden ears of wheat will wave in the wind.

Photo Canadian Official News Bureau



H Bastin

THE MANTIS AT ITS 'PRAYERS'

The praying mantis is one of the world's worst hypocrites, and its name might well be spelt "preying" Though it is named originally from its habit of holding its fore-legs in a way that reminds us of arms bent in prayer, it actually remains like this only to deceive other insects which it seizes in those same legs if they come within reach

Pacific Railway that changed Manitoba to the prosperous province of today The new line brought thousands of settlers from the older parts of Canada, from the United States, and from Europe, with the result that the population leapt from a white population of 1,565 in 1870 to its present total of about 700,000

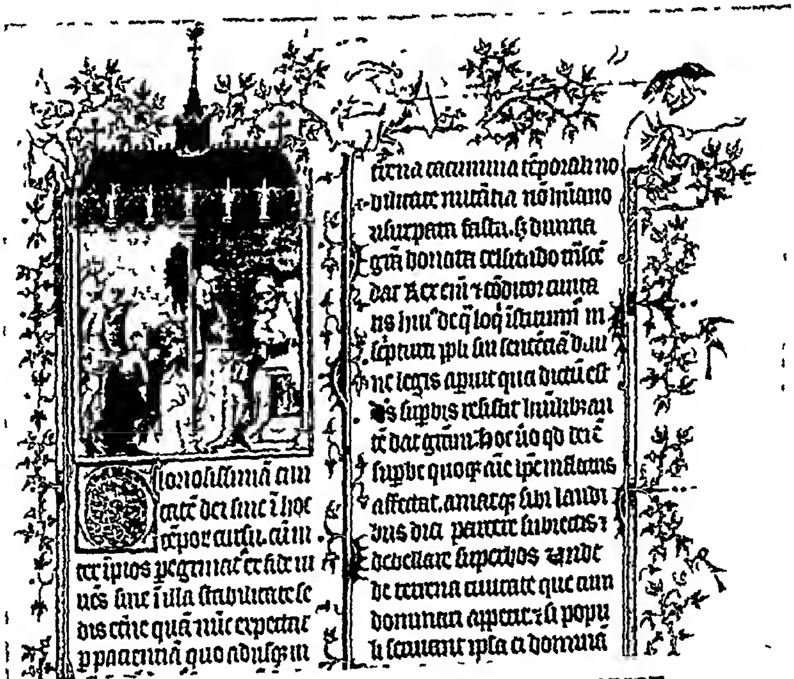
Mantis. Perhaps no living creature conceals behind a pious appearance a more bloodthirsty and malignant disposition than that great hypocrite, the "praying mantis"

With the front part of its body raised up in a prim pose, the hind part often reminding one of the flounce of an old-fashioned skirt, and with its fore-limbs folded up so properly beneath its small triangular head, the mantis does indeed look like an old lady at her prayers But concealed on the inside of those arms are sharp cruel spines, and that head, cocked now to the right, now to the left, holds two large eyes constantly on the look-out for unwary victims

Perhaps a fly ventures too near Suddenly the mantis springs, those long scythe-shaped arms shoot out, and the fly is caught on their curved barbs Then one leg after another of the unfortunate captive disappears in that greedy mouth, the body is sucked dry, and the mantis is back at its prayers

Members of the family *Mantidae* are found in Europe and in nearly all tropical countries The eggs are laid in tough cases attached to twigs, and as soon as the young hatch, they start killing small insects Their life-history is similar to that of grasshoppers and others of the order *Orthoptera*, which undergo no metamorphosis

Manuscripts, ILLUMINATED Perhaps the most beautiful of all early works of art in the western world are the lovely illuminated manuscripts which were produced in monasteries and "scriptoria" during the Middle Ages Some of these have individually become world-famous, while as a whole they show the highest

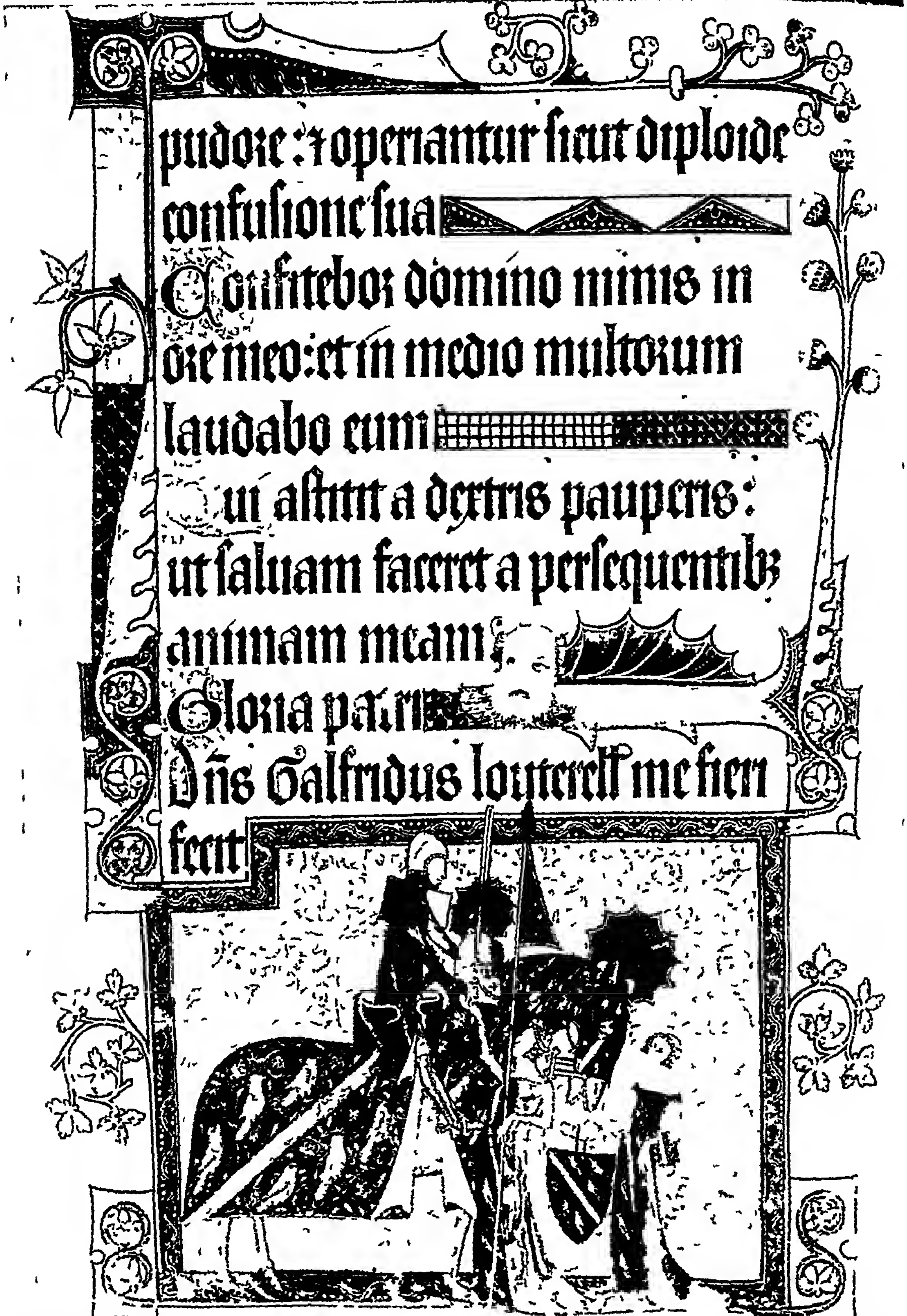


A BEAUTIFUL MEDIEVAL MANUSCRIPT

Here is a part of a page from an illuminated manuscript, done in France during the 14th century Observe the lovely little "miniature" above the ornate capital letter, and the beautiful "drolleries" which help to form the margin Work like this was done all over Western Europe during the Middle Ages

British Museum

PAGE FROM THE FAMOUS LUTTRELL PSALTER


pudore: ⁊ operiantur sicut diploide
confusione sua
Confitebor domino nimis in
ore meo: et in medio multorum
laudabo eum
Qui astitit a dextris pauperis:
ut saluam faceret a persequentib;
animam meam
Gloria patri
Dñs Galfridus louterell me fieri
fecit

Few illuminated manuscripts are so interesting as the Luttrell Psalter, which now holds an honoured place as one of our national treasures in the British Museum It was done about 1342 for Sir Geoffrey Luttrell, whom you see in the miniature at the bottom of this page He is depicted setting out to uphold his family s honour at a tournament, his wife handing him his helmet and a pennon, while another lady holds his shield On this, as on the trappings of his mount, are the Luttrell arms

form of art that graced those far-off times Illumination, as the art itself is called, consisted in the ornamentation of the covers and pages of the manuscripts, religious or otherwise, produced for patrons or religious houses At first, the illumination consisted simply of making the capitals and initials more and more complicated, and illustrating the text with lovely "miniatures", but gradually the ornament spread until the decorations round a single initial might occupy the margin of a whole leaf of vellum, and spread in and out of the text as well While brilliant colours were used for the decorations—though the actual initials themselves often remained in red—gold was extensively used for the backgrounds

Every country of civilized Europe had its own schools of illuminators, with their own particular styles, so that an expert can tell at a glance where any manuscript came from and about when it was executed One of the earliest and most remarkable of these schools was that which flourished in the Byzantine era (*see* Byzantine Empire), while there was another in Ireland during the 8th and 9th centuries, which produced the art known as "Irish Romanesque" The origin of this school, so different from any other and yet growing to perfection in so isolated a spot, is still something of a mystery, but it certainly shows the influence of Spanish art of that period It is remarkable for the complexity of the decoration, its richness, and the manner in which the whole sheets of vellum may be filled with glorious intertwining designs The lettering of this period was also very lovely, and a feature of these illuminated manuscripts were the full-page "miniatures" of the Evangelists This Irish school spread, via Lindisfarne, to England, and flourished for many years in the monasteries of the north The Book of Kells is its greatest masterpiece

Schools of Illuminators

In England, the Winchester school was later pre-eminent In this a very different style was evolved, the colours being pale and pure This type of work is illustrated in pages 1498 and 1514 In East Anglia, again, another school flourished, producing not only very beautiful manuscripts, but also some of surpassing interest, though of less artistic merit An example of this is the famous Luttrell Psalter, which is illustrated with a lovely series of miniatures showing us the whole range of the country life of the period Sports and pastimes, manners and customs, modes of business—every side of country life is shown in these little miniatures, and that is why we so often see them, and those from similar works, reproduced in our school history books, for they alone often provide a clue as to how our ancestors lived in the late Middle Ages

In France, in Flanders, and in Italy there were many notable schools of illuminators, each with its particular style France, especially, has produced some truly lovely works, principally the outcome of the great age of Gothic art, and done during the 13th-15th centuries Each figure, illuminated in fine colours against a background of gold leaf, is framed in a design similar to that of the stonework surrounding a Gothic church window

A further feature of these manuscripts is the inclusion in the margins of weird beasts and monsters of all sorts, these are known as "drolleries" The art of illumination declined in the 16th century with the coming of printing

CANADA'S TREE IN BRITAIN

Although it is not a native of Britain, the sugar maple, one of the most handsome and valuable members of its tribe, will grow to a fair size here under favourable conditions and the one seen above is a good example This is the tree from which comes maple syrup, and the leaf of which is Canada's national emblem

Photo R St Barbe Baker

Maple. The members of this group of trees, comprising the genus *Acer*, are among the most popular trees of the north The thick, spreading foliage, which casts a cool shade in summer and has brilliant tints in autumn, makes it one of the

MAKING MAPLE SUGAR IN A NORTH AMERICAN FOREST

In the maple forests when the sap is running, the great fire is never let out night or day as long as the season lasts. Somebody is always cutting wood to feed it; somebody is busy most of the time gathering in the sap; somebody is required to watch the kettles to see that they do not boil over and to fill them. It is not the boy, however; he is too busy!

most popular of all trees for town planting. So wonderful are the maples' tints that many people travel to Canada especially to see them in the "fall," as the autumn is called. The two species most often seen in Britain are the sycamore, or great maple, *A. pseudoplatanus* (see Sycamore) and the field maple (*A. campestris*). The latter, known by its soft, woolly leaves, lobed like those of all maples, is never a large tree, and is most common in the hedge row. Also grown here are the Norway maple (*A. platanoides*) and the ash leaved maple or box elder (*A. negundo*).

The chief of the family in North America is the sugar maple (*A. saccharum*), which not only yields maple sugar, but also produces the finest wood for furniture of any member of this family. Other common American species are the silver maple (*A. saccharinum*), whose branches are long and drooping, the red, scarlet, or swamp maple (*A. rubrum*), whose autumn colour is especially wonderful, and the lovely Japanese maples, with their deeply-cut, delicate leaves. Canada has adopted the maple leaf as its national emblem, and its song is entitled "The Maple Leaf For Ever."

The sugar maple also has fine wood for manufacturing purposes; tough, hard, and close grained, it is widely used for high grade furniture and interior joinery work. Gnarled sugar maples called "bird's eye" or "curly" maple, are cut for veneers for furniture.

Although all of the maples have sweet sap, the sugar or rock maple is the source of practically all the maple syrup and sugar that is marketed. Sugar production, however, is commercially important only in the north-eastern United States and the neighbouring parts of Canada, because the weather in the spring must be alternately freezing and thawing for a good run of sap. Continued cold or warm weather halts the sap flow. Sugar maples grow slowly, and they are seldom good sap producers before they are 40 years old. They yield the greatest amount after they are 80. The sap begins to run in very early spring and flows about three weeks. Each tree produces, on the average, about 10 gallons of sap. Boiled down, this yields about a quart of syrup, or two pounds of sugar.

How We Get Maple Sugar

So as soon as the season begins, workers are in among the maple trees, for to lose even a day or two of the run is costly, and the first few days yield the sweetest sap. For three or four weeks, while the nights are clear and cold and the days bright and warm, the men will work out in the sugar camp from early morning until the sun goes down.

The tapping is done carefully so as not to injure the tree. Each year it is tapped in a different place, so that in the summer the bark can grow over and heal the slight wound. Before drilling the hole for tapping the men vigorously brush down the trunk to remove

the dirt and loose bark, then, with a brace and bit, a hole is drilled about three-eighths of an inch in diameter, slanting up into the tree

Into the hole a spout, sometimes called a "spile," is driven Each spout has a hook from which the sap bucket hangs, but in some modern groves a system of pipe lines made of tin tubing has replaced the buckets

Sap is made into syrup by boiling out the excess water, and this is done at the camp The sap is poured into huge iron kettles and ladled from one kettle to another until, in the end one, it is thick enough for syrup To make maple sugar, the syrup is boiled down until it "sugars" In the larger groves, which may have as many as 2,000 trees, no boiling is done at camp, but the whole process is more industrialized Once ready, the syrup is canned quickly, so that it will not become sour by bacteria growth Or, if it is to be made into sugar, it is put into tin or wooden moulds and packed carefully for shipment

PUTTING *the* GLOBE *on* PAPER

One does not realize, until one tries, how impossible it is to represent a round object on a flat surface. This is the chief difficulty in map-making, and here we learn how it is overcome in practice.

Maps. It is comparatively easy to show the earth's surface on a globe, but it is difficult to do so on the flat surface of a map You will see why if you cut the skin of an orange into half-separated strips and remove them as a

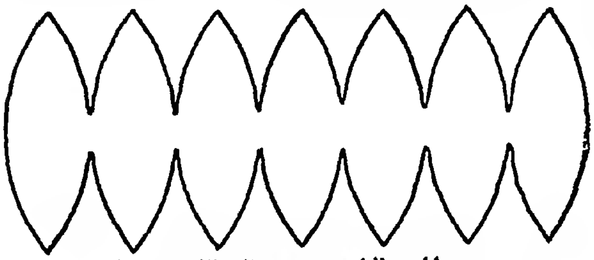


Fig 1 The "orange peel" problem

The nearest to a flat surface you could get by peeling off the surface of a geography globe would be a shape something like this, as you can find out by trying it on an orange

single piece The result, when flattened out, will resemble the drawing in Fig 1 Every boy discovers this difficulty of adjusting a flat surface to a sphere when he tries to cover a ball with a piece of leather, it can only be done by cutting the leather into specially shaped pieces and sewing them together

But it *is* possible to cover the surface of a "cone" with a continuous piece of paper, or other material, and make it lie flat One way of "projecting" maps, therefore, is to imagine the earth composed of two cones with the Equator as their common base In this way we prepare what is called a "conic projection," which is fairly satisfactory for single states and countries, and other small sections of the globe's surface The accompanying diagrams (Figs 2 and 3) show how a conic projection is made Such a projection is easily recognizable by the fact that the meridians are all straight lines diverging from a common centre, and the parallels are arcs of concentric circles In what is called a "polyconic" projection the meridians, however, are slightly curved, and

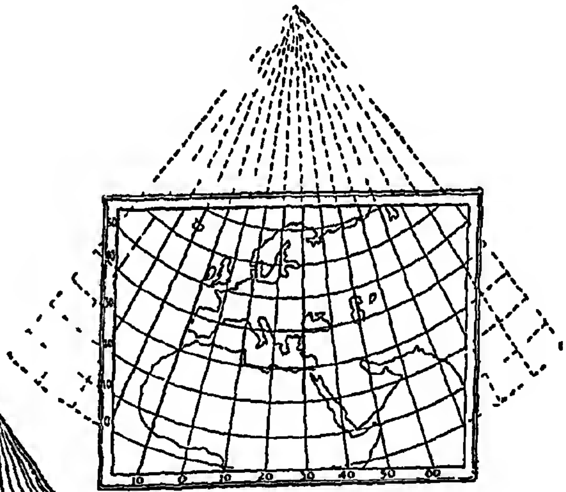


Fig 3 The completed conic projection

the parallels are not always concentric arcs This is because a separate cone is used for each parallel

Imagine a cone of paper fitted over the top of a globe touching the surface at, say, the 40th parallel of north latitude, as in Fig 2, this is then the "standard" parallel Meridians are drawn at equal intervals on the paper as straight lines from the apex of the cone to its base, and from

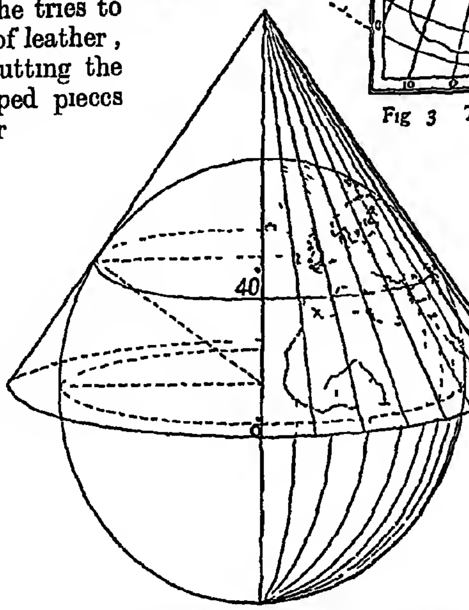


Fig 2 How a conic projection is made

above the parallels appear as concentric circles drawn with the apex as a centre

When the paper cone is unrolled it appears as in Fig 3 In conic projections the scale along every meridian and along the standard parallel is correct, but north and south of the standard parallel, latitude and longitude are progressively distorted This defect makes these projections useless as sailing charts

For showing the whole surface of the globe on a single map, what is called " Mercator's projection " (after its originator the Fleming, Gerard Mercator, 1512–94) is frequently used In making this projection the globe is imagined as enclosed in a paper cylinder (Fig 4) If the cylinder were of the same height as the globe, the east-and-west distances near the poles would be enormously exaggerated while the north-and-south distances would be practically correct

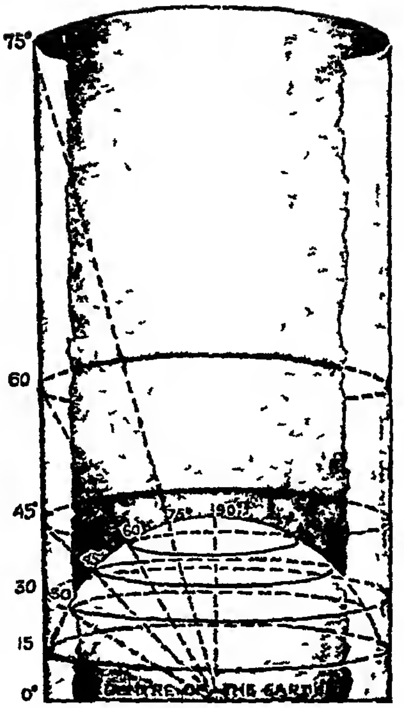


Fig 4 Mercator's principle

To remedy this distortion of shape, a corresponding distortion north and south is introduced Projection lines are drawn from the centre of the globe at regular intervals of latitude and continued until they meet the surface of the cylinder

Thus the distance between the 60th and 75th parallels of latitude becomes enormously greater than that between the Equator and the 15th parallel, and the poles cannot be shown at all on these maps Fig 4 explains how the Mercator's projection is formed, and Fig 5 what it looks like when it is completed In spite of its great exaggeration of areas towards the top and bottom of the map, this projection is very useful, especially for sailing charts All meridians and parallels are straight lines crossing at right angles, and a compass course between any two points is the straight line connecting them

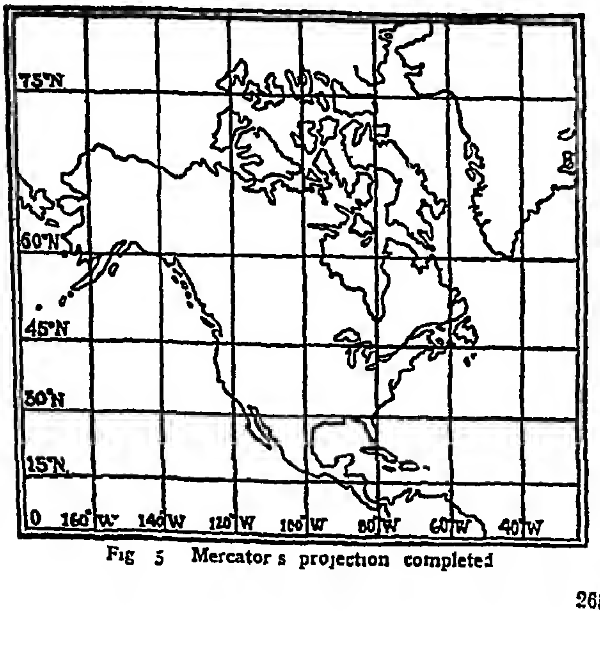


Fig 5 Mercator's projection completed

There are many other types of map projections, but these are among the simplest No map, it should be remembered, can ever represent the surface of the earth as accurately as a globe If you examine a map on a conic projection, and then one of the same area on a Mercator's projection, you will see a great difference in apparent size and shape And yet each is an accurate representation according to its system of projection Without projections we could not have the world mapped in a convenient atlas

Maps which show the character of the surface of the ground are of several kinds, known as ' relief " maps, ' topographic " maps, ' contour " maps, etc An example of a contour map is given in Fig 6 Such maps show the detail of the earth's surface by indicating with contour lines where planes of regularly increasing altitude would strike the surface of the ground In this case the planes are 20 feet apart Lines very close together indicate a sharp rise In Fig 7 we see how a profile sketch can be made from the contour map in Fig 6


Fig 6 Contour map of a coast-line

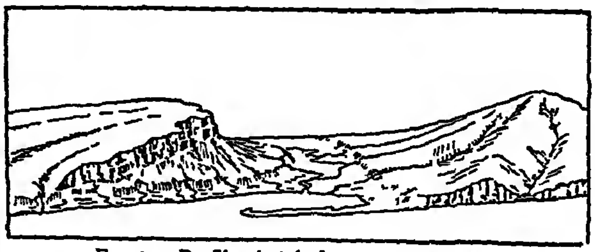


Fig 7 Profile sketch from contour map

The earliest-known maps were designed either to guide travellers or to illustrate contemporary

ideas on the nature and extent of the world. The oldest maps in existence are thought to be those on Babylonian clay tablets, now in the British Museum. These date from about the year 2300 B.C.—over 4,000 years ago!

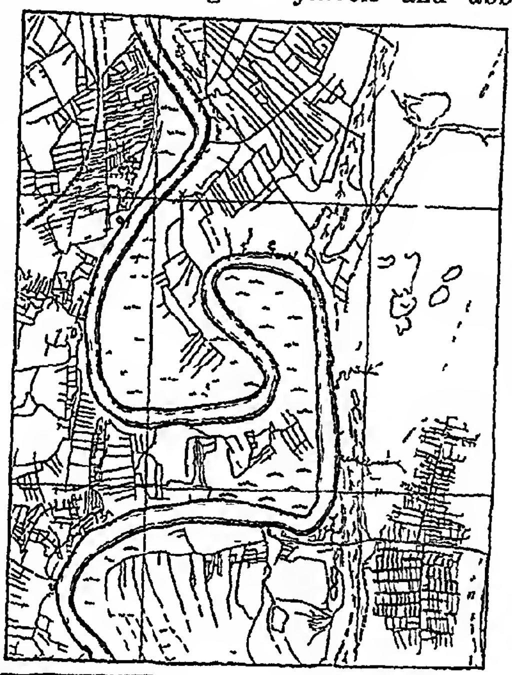
As men journeyed over more and more of the earth, so their maps became larger and more accurate. Those of the Egyptian geographer Ptolemy (c. A.D. 150) are extraordinarily good considering the period in which he lived. But his ideas of a spherical earth were eventually discarded, and cartographers represented the world on "wheel maps," with Jerusalem or some similar city as the supposed centre of the world.

Today it may be said that practically every quarter of the globe is mapped in detail. The official organization for map-making in Great Britain is the Ordnance Survey, which is constantly at work charting the country and revising old maps. The scale of maps published varies considerably, but one inch to the mile may be quoted as a popular map. This scale, also given as 1 : 63,360, means that one inch on the map represents one mile on the actual surface of the earth.

An atlas often gives various special maps, such as those illustrating rainfall, temperature, religions of the world, races, density of population, languages, communications and industries. In addition, it is usual to provide both physical and political maps of every land.

Motoring maps are really a specialized form, for in them the classes of roads and places are *particularly emphasized and distinguished* from one another. The student of map-reading should acquaint himself with the standard symbols and abbreviations used on maps; there is usually a key or reference panel to these, and also a compass bearing.

The Ordnance Survey has recently enlisted the valuable aid of the aeroplane in revising the map of Britain. From an air survey 'plane, with its exceptional mobility and all-embracing scope, the cameraman can take two types of photograph—the vertical and the oblique. The former is used for large scales, and the latter frequently for small scales over flat ground. The area is covered in a series of "strip" flights, and the exposures are pieced together in mosaic. (*See* illustration.)



MAP MADE FROM AERIAL PHOTOGRAPHS

The photographic map shown in the lower illustration was pieced together from photographs taken by the Air Operating Co. during a survey of Iraq. Remarkable though the mosaic is, it is far from clear. For this reason the line map seen at the top is prepared from it, showing all the essentials.

Marat, JEAN PAUL (1744–1793). Notorious for his violent character and on account of the dramatic nature of his death—he was murdered in his bath by Charlotte Corday—Marat has gone down in history as one of the famous, or infamous, leaders of the French Revolution of 1789.

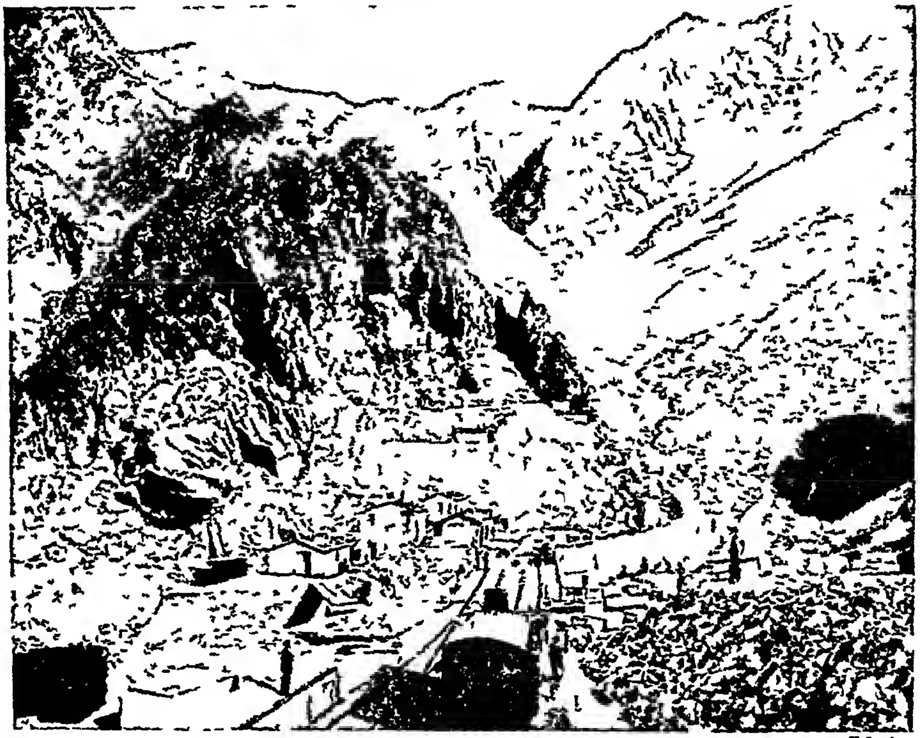
He began life as a doctor of medicine, but later transferred his energies to politics and journalism. When the thunder clouds of the revolution were gathering, Marat was one of the fiercest of the demagogues who by their appeals to class hatred aroused the *most violent passions* of the mob and ultimately brought about the "Reign of Terror."

After his assassination, July 13, 1793, he was buried with kingly pomp, and his bust replaced figures of the Virgin in the streets In 1795 his remains were placed in the Pantheon, but four months later they were turned out again "Such," as Thiers says, "is the instability of revolutions" (*See* illustration in page 1756)

Marathon. (Pron ma'-ra-thon) On the little plain of Marathon, in Greece, about twenty-five miles north-east of Athens, may be seen a great mound nearly fifty feet high Beneath it lie the remains of 192 gallant Athenians who gave their lives, 2,400 years ago (490 B C), to preserve their city and all Greece from conquest by the Persian hordes of Darius the Great

The mound, raised by their grateful fellow-citizens to receive their bodies and commemorate their heroism, was excavated in 1890, and the sacred relics were brought to light for the first time since the day of their glorious victory (For the story of the battle *see* Persian Wars)

The famous "Marathon Race" (covering 26 miles and 385 yards, the distance from Marathon to Athens) was founded in Greece in honour of the runner Pheidippides, who brought news of the victory to Athens, and died shouting, "Rejoice! We conquer!" A marathon race forms part of the English Amateur Athletic Association championships, and has been one of the classic events of the modern Olympic Games, it is still run over the same distance



MOUNTAIN SOURCE OF ITALY'S MARBLE

Some of the most famous of the world's marble quarries are those of Carrara in the Apennine-Italy The quarries have been worked almost continuously since the days of the Roman Empire, and Carrara marble has been used for buildings and statues all over the world This photograph shows the Ravaccione railway station which lies at the base of the famous quarries

Marble. We owe most of our supply of the beautiful crystalline rock called marble to countless millions of tiny sea animals, whose mineral remains have been pressed together into this form Limestone (*q v*) is formed in the same way, indeed, marble is merely limestone which has been altered, or "metamorphosed," by the action of heat and pressure

The colour of marble depends on the purity of the limestone from which it is made If considerable quantities of materials other than calcium carbonate or magnesium carbonate are present the colour varies according to the nature and distribution of these impurities in the rock Pure marble is white, but impurities may make it red, brown, yellow, black, etc, or, if the impurities are irregularly distributed, it may be mottled, or beautifully veined Onyx marble (which must not be confused with true onyx, a variety of agate) is formed by the precipitation of calcium carbonate from solution, usually from the waters of springs, its colours including white, yellow, and green

Marble has always been a favourite material with sculptors and architects because of its beauty The exquisite statues of the Greeks were made chiefly from the so-called Pentelic marble, from the quarries on Mount Pentelicus in Attica The Elgin Marbles in the British Museum were carved from this fine stone The beautiful Venus de' Medici in the Louvre at Paris was made from the Parian marble quarried on the island of Paros, in the Aegean

The marble most used by sculptors still comes from the famous quarries of Carrara in northern Italy, which furnished the material for the Pantheon at Rome

Marble is used for monuments, buildings, statues and for many other purposes Since it resists fire better than granite, it is much used in fireproof buildings In dry climates and when sheltered from rain, it is very durable but otherwise the surface is liable to crumble

The MAN *who* MASTERED WIRELESS

We owe more to Marconi than we realize, for not only has his work on wireless brought entertainment and education into our homes, but it has made the sea safe and thus increased trade

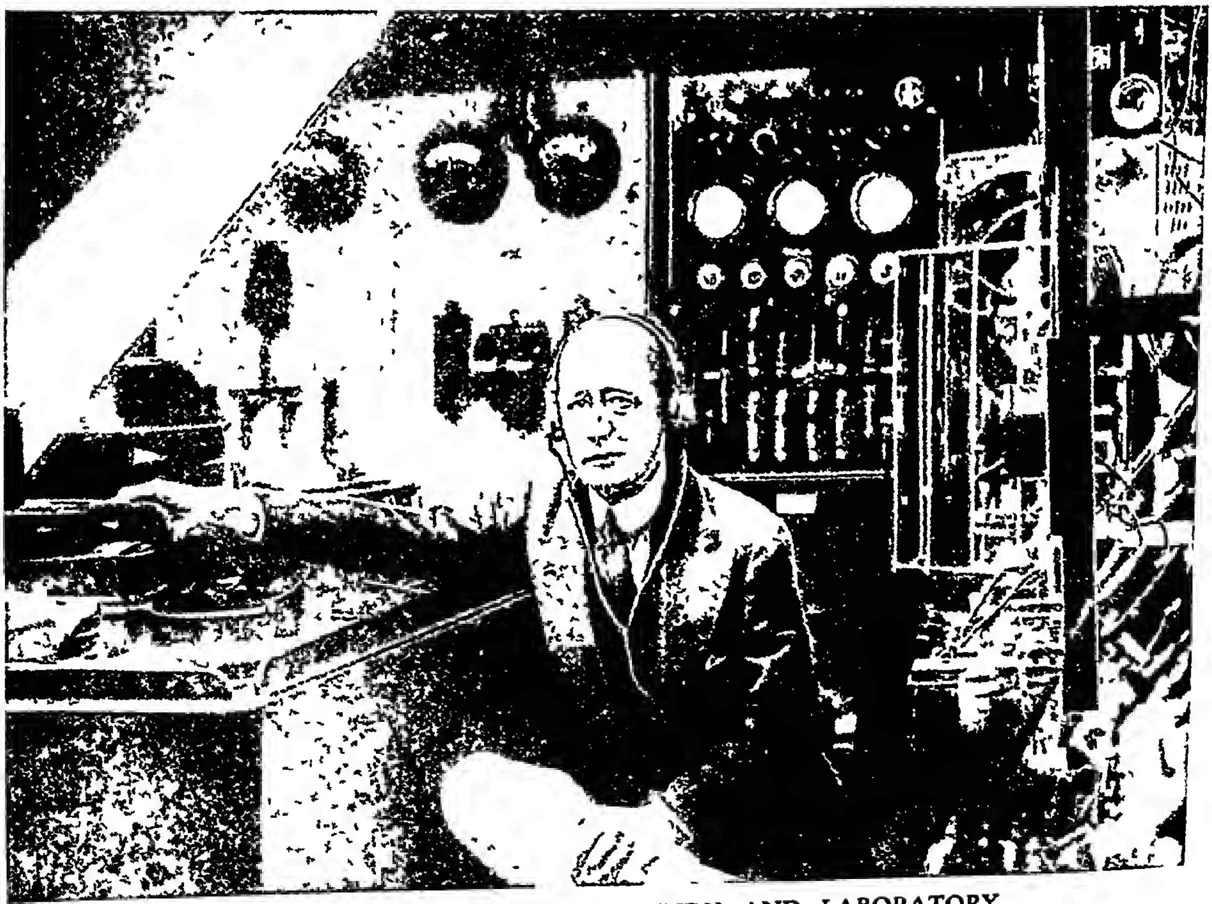
Marco'ni, GUGLIELMO (1874–1937) In a dusty little room of an old Newfoundland barracks, on December 12, 1901, Guglielmo Marconi sat among some queer-looking instruments, his eyes sparkling, nerves taut, a telephone headpiece clamped to his ears Outside a violent North Atlantic storm whipped the sea into huge waves Several men stood by watching Marconi They had faith in him, even though his purpose seemed fantastically impossible He was trying to receive a telegraphic signal out of thin air from across the Atlantic

Everyone was tense, silent For a time nothing happened Then suddenly there came a sharp tap Marconi raised his hand, listened a moment, then handed the headphones to his assistants for them also to hear the distinct clicks of the letter "S" These signals were being sent from Poldhu on the Cornish coast, 2,000 miles away Wireless communication across an ocean was an accomplished fact

The inventor was happy, but not surprised The marvellous accomplishment was merely the fulfilment of theories he had held since 1895, when he began experiments in methods of sending and receiving the electrical impulses known as Hertzian waves These theories were not entirely new Other men, like Hertz and Clerk-Maxwell, had laid their foundations

Marconi was born near Bologna, Italy, the son of an Italian country gentleman and an Irish mother Tall, fair-skinned, blue-eyed, he was British in appearance, but in manner Italian He was educated in both Italian and English schools, gaining his scientific training at Leghorn and Bologna Even as a small boy he was keenly interested in electricity

At Bologna he watched eagerly the experiments of Prof Righi with electro-magnetic waves and went on to make some investigations of his own In 1895 he set to work in earnest He substituted a vertical wire for the Hertzian



MARCONI IN HIS FLOATING STUDY AND LABORATORY

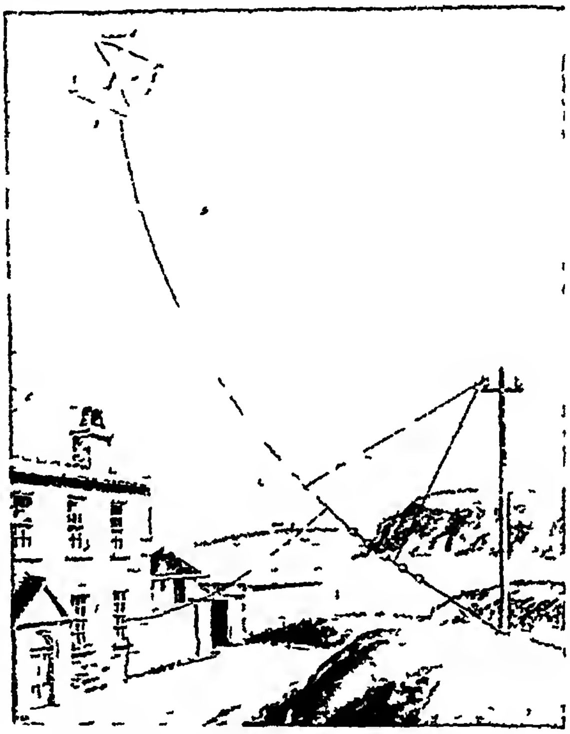
This portrait of the Marchese Marconi would appear, at first sight, to have been taken in a modern power station, not the cabin of his private yacht Elettra Marconi was devoted to life on the sea, and much of his finest research was performed many miles from civilization, indeed, he claimed that he could obtain ideal conditions for his research only when at sea It is the more fitting that he should have lived to see the fruits of his work successfully rob the sea of many of its terrors

form of resonator, improved the Branly coherer which he used as a detector, and invented an electric tapping device With this apparatus he could send messages more than a mile The next year he went to England and took out a patent—the first ever granted for a practical system of wireless telegraphy In 1897 a company was formed to exploit wireless commercially

By constant and patient work he continued to invent and improve the basic devices, sending messages farther and farther In 1910 he was able to receive signals at Buenos Aires from Clifden, Ireland, and in 1918 sent a message from England to Australia When Sir Ambrose Fleming invented the thermionic valve and made wireless telephony possible, broadcasting was successfully established and wireless communication made familiar to everyone

One of the first practical applications of wireless came in 1898, when Marconi followed the Kingstown Regatta races in a tug and flashed the results to a Dublin paper

As early as 1904 Marconi had established a ships' news service, which has grown so much that today ships thousands of miles out at sea receive bulletins of what is happening on shore almost as soon as it occurs, and passengers may receive and send personal messages or may even speak directly to persons on shore by radio telephone



MARCONI'S GREAT EXPERIMENT

This picture shows the barracks at St John s, Newfoundland, where, in December, 1901, Marconi erected his kite-flown aerial This was the aerial that picked up the first wireless signal, the letter S in Morse code, to be sent across the Atlantic

Courtesy Marconi Wireless Telegraph Co Ltd

In 1916 Marconi began extensive experiments to confine wireless impulses to a directed path, instead of letting them spread in all directions, as in ordinary broadcasting By using a parabolic reflector behind the antenna, Marconi and his engineers were able to focus short wireless waves as a beam, and to send them in one direction only "Beam transmission," perfected in 1922, is now employed by most world-wide wireless communication systems Marconi sponsored and developed many special applications of his beam system Among his inventions to help to save lives at sea is a beam lighthouse that can direct signals to give ships their shore bearing in a fog In 1934 he successfully demonstrated transmitter equipment that makes blind navigation of ships possible

He applied wireless waves less than one metre long to a wireless telephone for communicating over moderate distances In 1932 this system was adopted for telephonic communication between Vatican City and the Palace of the Pope near Rome

Marconi was awarded the Nobel Prize for physics in 1909 The same year the King of Italy nominated him a member of the Italian Senate A motor accident cost Marconi the use of his right eye in 1912, but he did not let this handicap interfere with his work or his favourite sports of yachting, motoring, cycling, and hunting He served in both the Italian army and navy during the World War In 1919 he was appointed plenipotentiary delegate to the Paris Peace Conference In 1929 he was created a *marchese* (marquis) He died July 20, 1937

Marcus Aurelius Antoninus, Roman Emperor (A D 121–180)

In the second century of our era the peace and happiness of the civilized world depended largely upon whoever happened to be the Roman emperor He ruled Rome and Rome ruled the world But the ruler of Rome had a task of appalling difficulty Generations of ease and luxury had made the patricians flabby and selfish The middle class was rapidly being reduced to slavery and despair Germanic barbarians were pressing at the borders, and few Romans seemed willing to fight in defence of their country The armies themselves were recruited largely from barbarians These were the conditions which Marcus Aurelius faced when he became emperor in A D 161

Marcus had been marked for this task almost from birth It was usual at that time for Roman emperors who lacked sons to adopt kinsmen as their successors and train them for imperial duties Marcus was adopted and educated by his uncle, who later became the Emperor Antoninus Pius, and when Antoninus died, Marcus succeeded him Marcus Aurelius had been trained in the Greek Stoic philosophy, and followed it throughout his life Although the wealth of the Mediterranean world was at

his disposal, he chose to dress plainly, live frugally, and work from early morning to midnight "Blot out vain pomp, quench appetite, keep reason under its own control," was his advice to all Romans

He placed the good of society before his own individual comfort "What is not good for the swarm is not good for the bee," he wrote He put good government into effect, limited the gladiatorial games, and passed laws benefiting slaves, heirs, women, and children This pagan emperor, by the nobility of his principles, attained something like the loftiness of Christianity but he persecuted the Christians themselves, for fear they would destroy the state Though he loved peace, he was a good warrior and throughout his life succeeded in defending the border provinces against invasion

In his few spare moments, whether between battles or in the noisy amphitheatre, he jotted down in Greek the rules that guided his own conduct The resulting volume of 'Meditations" is one of the world's great books of wisdom Worn out by war and the burdens of state, he died in March of A D 180

MARCUS AURELIUS IN TRIUMPH

Philosopher and soldier, Marcus Aurelius was the last of the "five good emperors," whose reigns mark the golden age of the Roman Empire In this relief he is seen riding among his guards, and receiving the submission of barbarian chieftains whom he had conquered

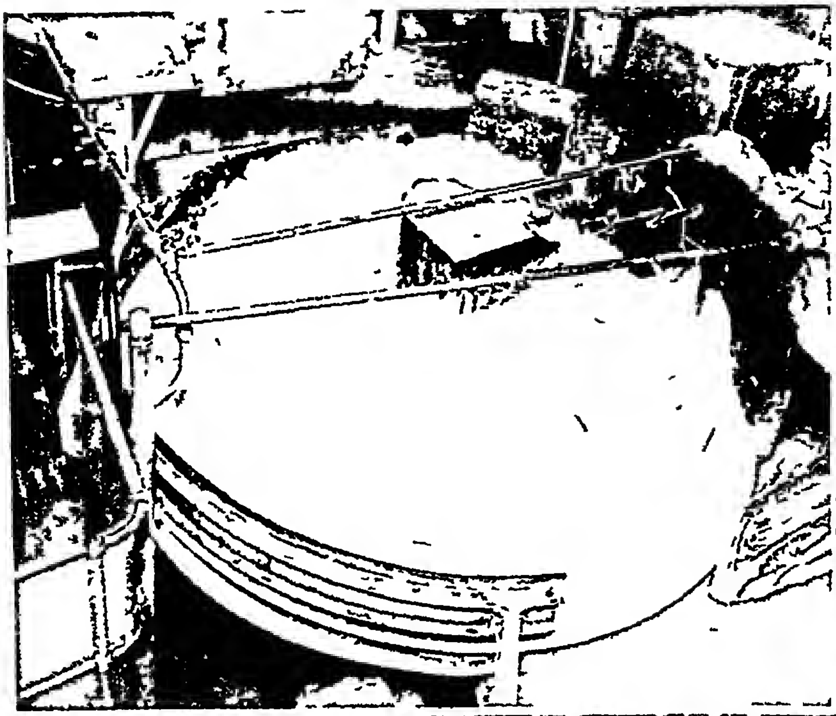
Capitoline Museum Rome photo Anderson

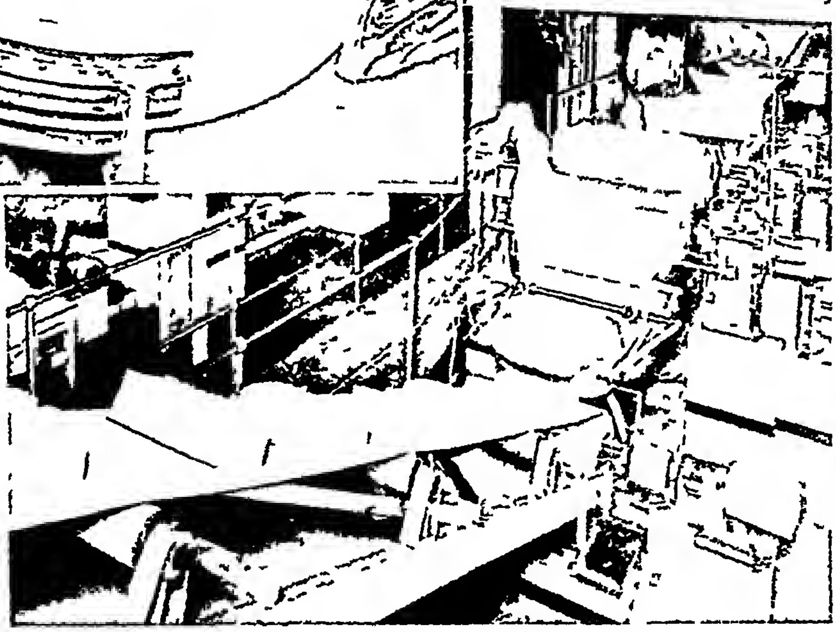
Margarine. A prize was offered by the French government at the time of the Franco-Prussian War to anyone who could produce a good substitute for butter The prize was won by Mege-Mouries, a French chemist, who originated a process for making a product from beef fat called margarine, or oleo-margarine This proved to be a good substitute, for it had the appearance of butter, contained similar amounts of fat and other food elements, though lacking certain factors since discovered, and was cheaper than good butter and more wholesome than poor grades It was a real boon to the peasant class, and its use spread rapidly in the countries of Europe

Since those pioneer days the manufacture of margarine has developed into one of the largest of our food industries Research directed towards the improvement of its nutritional value, appearance and flavour, has so transformed margarine that in the eighth (1936) edition of their "Food and the Principles of Dietetics," Dr Hutchison and Professor Mottram write 'Margarine is now made only from pure fats, and the processes to which it is subjected in manufacture insure its further purification As the flavour of the best variety is equal to that of an average specimen of butter, and as it has the advantage of being very much cheaper, there is every reason to wish that the prejudice against it should quickly disappear, and that it should be welcomed as an admirable and cheap substitute for a rather expensive, but necessary food '

The oils and fats which furnish the basis of the industry are largely of vegetable origin This was made possible by the discovery of a process for introducing hydrogen into them, thereby raising their melting-point as without such processing they would remain liquid at ordinary temperatures Ground nuts, coconuts (copra), palm kernels, soya beans, and other oil-bearing fruits are used in vast quantities They are crushed between rollers, and the oils are extracted and refined to a point of absolute purity Milk is the other major raw material It is pasteurized, then inoculated with a standardized culture of the lactic ferment, and kept under carefully-controlled conditions so that the butter aroma may develop

The refined oils and fats are blended and churned with the conditioned milk The result is a cream-like emulsion which passes over great revolving cooling drums and is thus solidified It is kneaded and "worked" to plasticize





HOW MARGARINE IS MIXED

The majority of margarines are made from vegetable oils, expressed from copra, soya beans, etc, and mixed with milk In the upper picture here the mixture is being kneaded by a machine which gives it its proper consistency From the 'kneader' the mixture passes to the 'multiplexing' machine (lower) from which it emerges in solid slabs

Courtesy of Van der Berghs & Jurgens Ltd

and give consistency to the texture of the product Salt (in proportions varying according to the preference of customers) is added, and the margarine is ready for the weighing and packing machines Throughout this sequence of processes the product in the modern factory is not touched by hand

In the best brands of margarine today are incorporated the fat-soluble vitamins A and D This gives margarine an equal vitamin value with butter, indeed, margarine has the advantage that its vitamin content is kept constant throughout the year and does not vary with the seasons

Maria Theresa, Empress (1717–1780) Difficulties surrounded Maria Theresa when, in 1740, at the age of 23, she was proclaimed Archduchess of Austria and Queen of Bohemia and Hungary The young and beautiful but inexperienced queen was surrounded by a circle of enemies The unscrupulous Frederick the Great of Prussia took advantage of her youth and sex to seize the rich province of Silesia The "Pragmatic Sanction," by which her father Charles VI had sought to change the Hapsburg rule of succession to permit the rule of a woman, was flouted Bavaria and Saxony claimed Austria's lands with France's support, and Spain threatened her Italian provinces The result was the war of the Austrian Succession (1740–1748)

Maria Theresa was not one to sit idly by while her lands were torn from her, and the Hungarian people and nobles came gallantly to the rescue of their young queen Her most dangerous enemy, Frederick of Prussia, made peace in 1742 and, though he re-entered the war in 1744, his interest centred exclusively in Silesia When peace was finally made in 1748 at Aix-la-Chapelle, Maria Theresa was forced to confirm the cession of Silesia to Prussia and to give up some of her Italian possessions to Spain, but retained the rest of her lands Meanwhile her husband had been elected Emperor as Francis I

The loss of her possessions hurt Maria Theresa, and she set herself industriously to win France from its 200 years' enmity to Austria, in order that she might recover them An alliance with France was brought about in 1756 by her clever minister, Kaunitz This she sealed later (1770) by the marriage of one of her 11 daughters, Marie Antoinette, to the dauphin of France Great Britain at this time decided to abandon her old Austrian alliance, and formed a new one with Prussia When, therefore, the "third Silesian war" broke out in 1756—this broadened into a war between England and

MARIA THERESA APPEALS TO THE HUNGARIANS

The death, in 1740, of the Emperor Charles VI was followed by the accession of his daughter, Maria Theresa, and by the claims of other powers for a share in the Hapsburg dominions At the approach of the allied army to Vienna, Maria Theresa fled to Hungary, where she is said to have appeared before the parliament at Pressburg, with her infant son (later Joseph II) in her arms Stirred by her appeal, the whole assembly (so the story runs) rose, and, drawing their swords, exclaimed, "Our lives and our blood for your Majesty! We will die for our king, Maria Theresa!"

From a painting by Laslett J Pott

France—Maria Theresa found herself, in spite of an alliance with Russia and the desperate straits to which Frederick was reduced, still quite unable to force Prussia to loosen its clutch upon Silesia

Marie Antoinette. (Pron ma-rē-ahn-twah-net′) (1755 1793) QUEEN OF FRANCE Somewhere about noon on October 16, 1793, a

MARIE ANTOINETTE
The tragic queen of Louis XVI of France who, with her husband met death on the guillotine in the French Revolution, is here seen portrayed by Le Brun with her three children Her extravagance, though stories of it were exaggerated, helped to bring about the Revolution
Versailles Museum photo Mansell

cart rumbled slowly through the Paris streets amid the howls and jeers of the populace In it sat a woman in a ragged white dress with hands bound behind her, yet with traces of majesty in her stricken bearing and of beauty in her wasted face At the Place de la Revolution the victim alighted, then mounted the steps of the scaffold, and lay her prematurely-whitened head beneath the knife of the guillotine Such was the end of a great empress's daughter, once the gayest and most beautiful princess in Europe

Marie Antoinette, fourth daughter of Maria Theresa of Austria, was married at fifteen to Louis XVI of France, then dauphin or heir to the throne A frolicsome, reckless, extravagant child, she shocked the more sober members of the French court by her disregard of etiquette When she became queen (1774), her open favouring of Austrian interests and her enmity towards the statesmen Turgot and Necker aroused distrust When the French Revolution broke out in 1789 the people came to think that their miseries were in part caused by the extravagances of "the Austrian woman"

Meanwhile she had become an obstinate woman who forced the king into a reactionary policy A believer in absolutism, she disliked even liberal monarchists like Lafayette and Mirabeau, and utterly failed to understand the troublous times into which she was flung The monarchy's last hope of wise counsel died with Mirabeau's death in 1791 Less than three months later Louis XVI was persuaded to repudiate the reforms he had promised to accept, and attempted to escape with his family from France with a view to war They were captured and brought back to a darkening fate

In August, 1792, charges of treachery in the war with Austria led a revolutionary mob to storm the Tuileries palace seize the royal family, and thrust them, prisoners, into the Temple From there the king was led in December to trial, and in January to execution The queen was taken in August, 1793, to the prison of the Conciergerie, where common criminals were confined Amid insults and brutality she bore herself with dignity and patience, but was convicted of treason, and her execution by the guillotine followed

Marigold. In the Middle Ages various golden-yellow blossoms that grew in profusion throughout southern Europe were dedicated to the Virgin Mary and called "Mary's gold" or marigolds From those developed our own marigold, the sturdy old-fashioned flower which was the delight of our grandmothers A native of the Mediterranean region, it has been

H Bastin
MARIGOLDS IN THE CORN
One of the worst weeds of the cornfield is the marigold, whose yellow daisy-like flowers are in flower during the summer months Here you see a crop of oats in which there seems almost as great a growth of marigolds as of the cereal itself

cultivated for over 300 years, and now blooms in our gardens from midsummer until the autumn frosts. Its large yellow or orange blossoms have a strong though not unpleasant odour.

The marigold curls up its rays at sunset, and in the early morning the dewdrops nestle in the folded petals. Hence Shakespeare speaks of "the marigold that goes to bed wi' the sun, and with him rises weeping." The common wild "corn marigold" is often a nuisance as a weed, so that English farmers call these plants "bother'ems."

These flowers are all of them members of the order *Compositae*, having both ray and tube florets. (*See* Flowers.) The name of the common species is *Calendula officinalis*.

A WONDERLAND *beneath the* WAVES

Deep-sea divers have discovered a new world full of life and colour many thousands of feet beneath the sea's surface. From their descriptions of what they have seen a vivid picture of it can be painted.

Marine Life. Nearly three-quarters of the surface of our globe is covered by the sea. So vast is the area of the ocean that even the great continents of the earth are but islands in its midst. Even so, its area—the Pacific Ocean alone covers some 64,000,000 square miles—represents but a fraction of its vastness. But it is when one contemplates the mighty volume of salt water represented by the great valleys and depressions which it fills in the crust of our globe—in places more than 5 miles in depth—that the human mind is staggered by the immensity of the great salt seas.

Beadlet Sea-Anemone

Wonderful is the sea with its tides and waves and currents, its placid calms and terrible storms, its rocks and reefs, its icebergs and waterspouts. But a thousand times more wonderful is its teeming and varied life under the surface. There are many great "unknown continents" still remaining to be explored in the vast areas of the mighty deep; but incomplete as our knowledge of the sea and its inhabitants is at present, we do know enough to convince us that the forms of life in the sea are as varied and as wonderful as the infinite and diverse species of animal and vegetable life on the dry land.

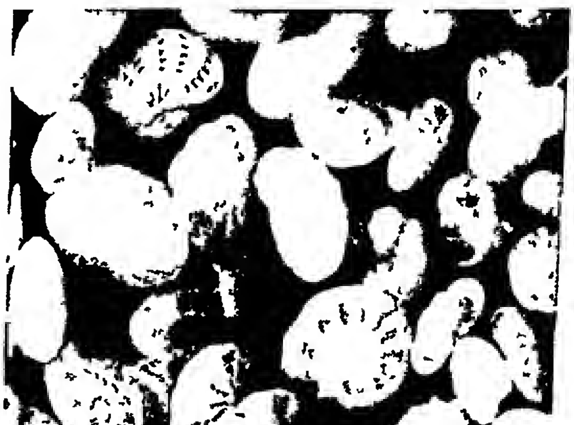
Not only has every sea its distinctive inhabitants, but in all but the shallowest waters each stratum of depth is like a storey of a house, with a different world of creatures on each floor!

On the ocean bed there is as varied a salt-water vegetation as can be found in the terrestrial forests of all the lands of the earth.

And in the same way as our woods and forests shelter and support millions of inhabitants of thousands of species of animal life, so amid the thickets and jungles of the sea-floor, and floating and swimming in the waters above it, are inconceivable myriads of creatures which are the successors of similar animals and fishes that have populated these same waters since the beginning of life—for, according to most theories, it is in the sea that life began, billions of years ago.

These living creatures of the sea are of every size and shape, varying in structure, in colour, and in habits of life just as widely as do the insects and animals of the dry land. Hundreds of living creatures, so tiny that a single drop of salt water may contain thousands of them, have been identified by scientists with the aid of the microscope, and every part of the sea from pole to pole, and from the surface to 30,000 feet and deeper, is teeming with these minute forms of life.

Some idea of the inconceivable numbers of the lowest forms of life in the ocean, and their use in Nature through the ages, can be obtained when one bears in mind that such enormous depths of chalk as now underlie the south of England and elsewhere, as well as the older and harder limestones, were built up by the depositing on the bottom of the sea of the shells and debris of microscopic creatures that lived in far-back ages. Similar deposits are being built up in our own time on the bed of some of the oceans by the



F. A. Botting

TINY SHELLS FROM OCEAN OOZE

At the bottom of the deeper seas, there is a deep layer of ooze, the debris of centuries of life from the waters above. Here is a sample of this ooze, consisting of innumerable tiny shells—these are very highly magnified—of the minute creatures called Foraminifera

AN ARTIST ON THE SEA FLOOR

Painting by Pyie Cheverlange

To face page 2660

See text overleaf

AN ARTIST ON THE SEA FLOOR

KEY TO COLOUR PLATE

OVER the door of his Tahiti house a bronze plate informed the passer-by that Elie Cheverlange was a 'Painter of Fishes'. In the pursuit of this unusual profession he visited many of the other South Sea islands, among them the Tuamotu or Paumotu Archipelago to the east, where the material for the painting overleaf was gathered.

The picture shows the artist walking among the coral formations near shore, lead-soled shoes on his feet to keep him on the bottom, a pair of pearl diver's waterproof goggles over his eyes, a clothes peg to prevent him from drawing in water through his nose, and in his mouth the end of a long rubber air-tube leading to a float on the surface. Because he breathes in and out through the same tube, which thus accumulates carbon dioxide, he cannot stay down more than 20 or 25 minutes at a time. But this is long enough to make sketches and colour notes with a scratching tool on a copper plate coated with dark paint. He carries these implements in his belt. To master difficult details of structure and colour he captures specimens and studies them in a small aquarium on shore.

Few of the creatures he encounters in those far-away waters have popular names in English. Those shown here are *Dascyllus aruanus* (1 and 14), *Holocentrus leo* (2 and 8), *Forcipiger longirostris* (3), parrot fish (4), *Acropora prolifera*, a species of coral (5), *Chaetodon ephippium* (6), cup coral (7), sickle fish or Moorish idol (9), millepore coral (10), sea urchin (11), *Balistapus aculeatus*, a species of trigger fish (12), algae of the Dyctiota genus (13), and *Acropora hyacinthus* (15).

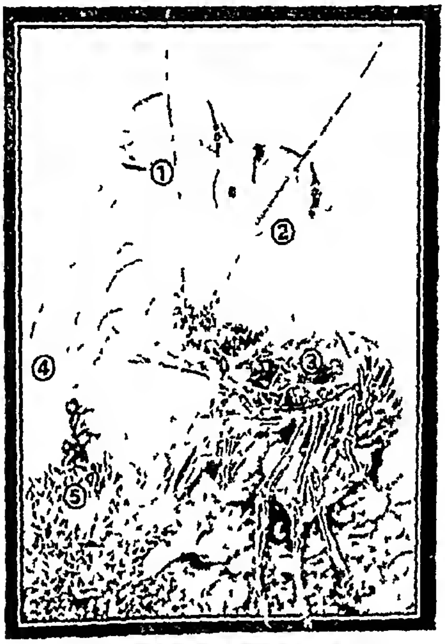
Elie Cheverlange is a French war veteran, winner of the Médaille Militaire and the Cross of St. George. He still regards Tahiti as his home, although he is away much of the time illustrating scientific publications in many parts of the world.

SOME OF HIS UNDER-WATER PORTRAITS

Painted by ELIE CHEVALLANCE [illegible]

The [illegible] in this plate as well as those in the plate facing page 2660 are portraits in the true sense of the word. They were [illegible] by the artist from actual observations, sketches and colour notes made while [illegible] on the ocean [illegible]. The detailed [illegible] of this remarkable achievement and the identity of his living model will be [illegible] the text [illegible]

SOME OF HIS UNDER-WATER PORTRAITS



KEY TO COLOUR PLATE

THE picture on the preceding page was painted from life by Elie Cheverlange while the artist was studying fishes in the waters surrounding the island of Tahiti, where he then made his home The creatures portrayed can be identified with the aid of the small key-picture at the left At the top are two members of the Chaetodon family, small, lively colourful swimmers of the South Seas, sometimes called "butterfly fish" The two species shown are *Chaetodon citrinellus* (1) and *Chaetodon falcula* (2) Below them with great outspread feelers rests a tropical relative of our common lobster, *Palinurus penicillatus* (3) He belongs to the group sometimes called spiny lobsters or sea crawfish, and is distinguished by the absence of the large pincers carried by his cousins of the Atlantic Ocean As a table delicacy, however, he is considered more than a match for the latter

The still life in the painting includes whip coral (4), stony coral (5) and green calcareous alga fringing the bottom of the frame

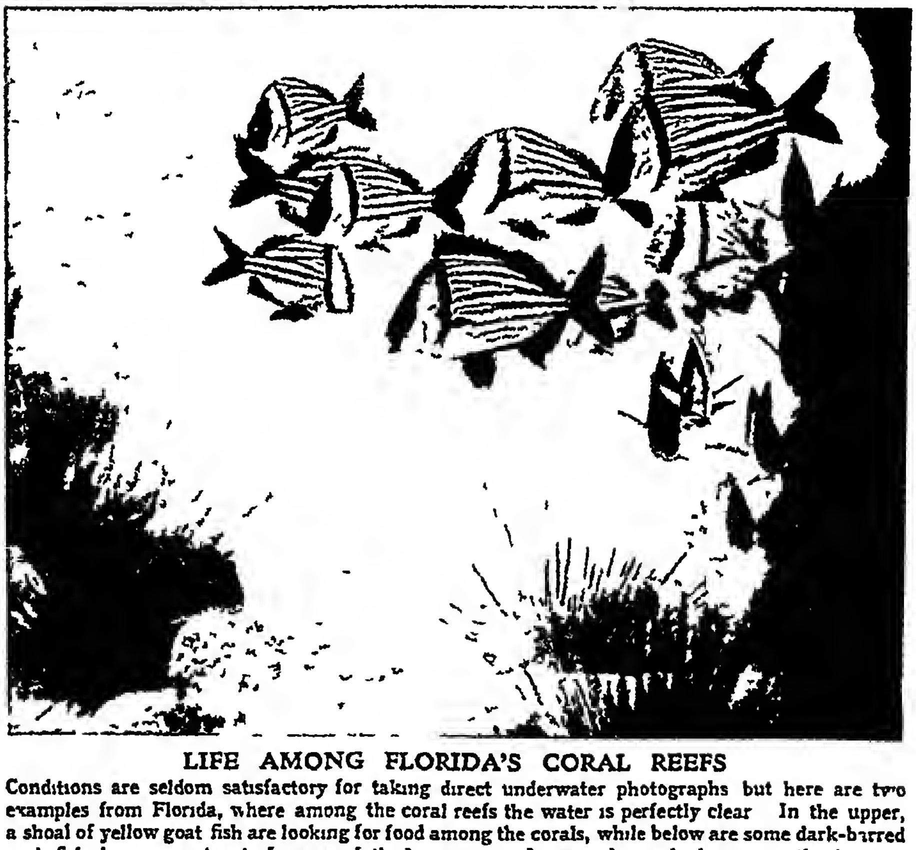
No less interesting than the details of the picture itself is the manner in which the artist gathered his material on the ocean bottom The plate facing page 2660 shows him on one of his under water tours of exploration and observation The painting for that plate was specially made to illustrate the unique procedure he followed in painting the pictures which have won for him a high place among the relatively few Nature painters who combine fine artistic ability with scientific method

His odd appearance in this self-portrait is due to the faithful representation of two items—the common clothes-peg he is wearing on his nose and the hair of his head which, with its tendency to float, seems to be standing on end

More information about this artist's method of working under water will be found on the back of the first plate

furnishes food to myriads of sea-birds and animals that live on its shores, and also no inconsiderable amount of the food required by Man

It is true that the area of the sea from which mankind takes his toll of fish is very small compared with the vast extent of the ocean, and yet millions and millions of food fishes are caught every year, even within a comparatively few miles from the coasts of Great Britain Despite continuous fishing for centuries, and the fact that many mature fishes, and even seals



LIFE AMONG FLORIDA'S CORAL REEFS

Conditions are seldom satisfactory for taking direct underwater photographs but here are two examples from Florida, where among the coral reefs the water is perfectly clear In the upper, a shoal of yellow goat fish are looking for food among the corals, while below are some dark-barred pork-fish, keeping just out of range of the long spines of sea-urchins which rest on the bottom

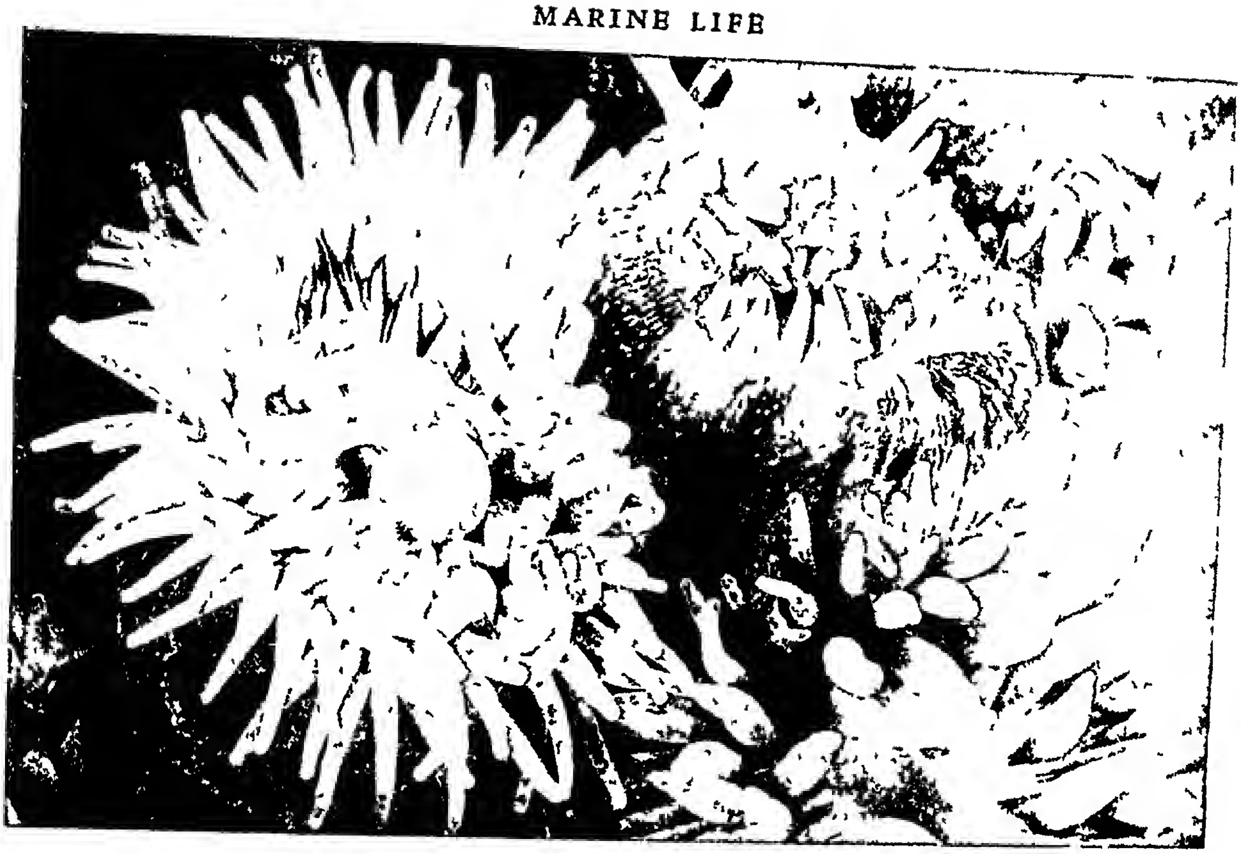
Photos Prof W H Longley

same marvellous agency, and in the great depths each layer of "ooze" has its own name and is composed of distinct types of animalcule

From the microscopic the orders and species of marine life ascend in the scale step by step to the leviathans If we omit some of the intermediate forms, marine life may be classified upwards from the protozoa through the sponges, corals, anemones, starfishes, molluscs, worms, crustaceans, fishes, turtles, dolphins, whales, and, finally, the highest of all—the seals

In such a wonder land of sea life it is but natural to find many remarkable creatures, and in connexion with even the commonest and most familiar of them—namely, the fishes—many facts of entrancing interest arise Not only do all the living creatures of the sea find all their food in the sea itself, but the sea also and sea-birds, continually prey upon the food fishes used by Man the supply does not appear to be appreciably diminished

Some species, e g the herring, may forsake a particular locality, with the result that fishermen



Dr Graf Zedtwitz

SEA-ANEMONES WITH THEIR POWERFUL TENTACLES

Few objects found around our shores are so attractive as the sea-anemones, those "flowers" of the rock pools whose colours and whose habits are so fascinating Those you see above have been feeding, for their tentacles are gradually closing inwards, a sign that they are going to retire "into themselves" while they digest the little fish or other creatures they have seized and swallowed

declaim against trawlers and declare that certain fish have been brought to the point of extinction by over-fishing But elsewhere other fishermen may be catching more of these fish than ever

Nature has provided many safeguards against the extinction of any particular species Fish in the breeding season are astonishingly prolific, some kinds laying literally millions of eggs Most fish lay eggs that float and that are more or less transparent Then, again, there are almost infinite areas of the ocean that are never fished, so that Nature always has a reserve sufficient for all the requirements of the creatures which constitute links in the chain of marine life

Among the innumerable strange and wonderful creatures that inhabit the sea few are more remarkable than the coral-making animals (*See* Coral and plate facing page 1142) These extraordinary little workers occupy a position between the plant and animal kingdoms in the sea The coral animal is born from an egg, and for a time it swims, like a marine worm, then it adheres to some object, becomes a fixture like a plant in the soil, and henceforward lives the life of a marine plant, generally in great communities, which in time build up, by their ceaseless industry, reefs and islands of coral rising above the surface of the sea

The struggle for existence is as intense among marine life as it is in the animal kingdom on land—indeed, more so Certain kinds of whales and large fish follow the great shoals of such fish as herring and prey on them incessantly, while swarms of other species, again, not only devour the food fishes that are enveloped in the fishermen's nets, but destroy the very nets themselves

Some fish have been furnished with remarkable weapons of attack, which make them literally terrors of the sea In practically every museum one may see the bony sword of the sword-fish, a huge species sometimes fifteen feet in length, which has been known to thrust its sword-like jaw through the bottom of a boat, and even to attack the oak timbers of large sailing ships with such fury that the sword has broken off and started a leak This is no relative of the terrible saw-fish, a flattened species whose blade has projections like saw-teeth all along its edges

Octopus Terror of the Deeps

Another terrible monster of the deep is the octopus, which has eight long arms each provided with two rows of suckers Lurking in some rocky fortress at the bottom of the sea, the octopus uses its arms to seize and draw in its prey, which once gripped by these entwining arms cannot escape (*See* Cuttle-fish)

Amongst the higher orders of marine life are the seals, of which there are many varieties These are not fish but mammals, and although some of them are able to stand and walk on their four limbs, or even to stand on their hind limbs

alone, like the bears (to which, indeed, they seem to be related), they live an aquatic life They are for the most part inhabitants of the Arctic and Antarctic seas

Whales, which belong to the same order as the porpoise, the grampus, and the narwhal, are the greatest of all marine creatures, as the elephant is the greatest of the land animals The whale is not a fish, but a mammal Its young are born alive, but they never leave the water as the young seals sometimes do There are various kinds of whales, the most valuable from a commercial point of view being the large blue whale of the Antarctic seas, which often measures 100 feet in length

Mark Antony (c 83–30 B C) The story of Mark Antony (or Marcus Antonius) and Cleopatra (*q v*) is one of the greatest romances of history After rising from the position of an absconding debtor to that of the virtual ruler of Rome, Antony sacrificed the dominion of the world on the altar of his infatuation for Cleopatra

Mark Antony, after a mis-spent youth, gained great distinction as a soldier and as military leader in many campaigns, he led the left wing of Caesar's victorious army at Pharsalus Before he was forty he became the powerful joint-consul with Caesar himself After Caesar was assassinated by the conspirators, Antony made his famous speech "Friends, Romans, countrymen " as staged in Shakespeare's "Julius Caesar" He triumphed in the war which followed, and became the ruler of the whole of the eastern division of the Roman dominions, while Octavian, Caesar's adopted son, ruled the west Afterwards Antony became infatuated with Cleopatra, and neglected the interests of Rome Only when he learned that his family was at war with Octavian did he return to Italy Octavian defeated him in a naval battle at Actium, and the following year (30 B C), disgraced and humiliated, he killed himself

Marlborough, 1st DUKE OF (Pron mawl' brê) (1650–1722) When John Churchill at fifteen became page of honour to the Duke of York (later King James II), he was almost unknown When he died, nearly sixty years later, he had been made Duke of Marlborough, and was renowned throughout Europe as the greatest general of his age and one of its greatest statesmen Many things helped him The friendship of the Duke of York for his sister Arabella won for him his appointment as page, and later, at the age of seventeen, a commission in the army He learned the art of war while serving under the great Marshal Turenne in a war with the

THE GREAT DUKE OF MARLBOROUGH

The first Duke of Marlborough was one of the greatest generals of all time, and won every battle that he fought in command of the armies of the Grand Alliance against France This portrait of him is by Sir Godfrey Kneller (1646–1723) As was often the way of artists of that period, the painter has surrounded the figure of Marlborough with allegorical figures, one of whom is placing a crown of laurels on his head

National Portrait Gallery London

Dutch His rise at court was further aided by his marriage at the age of twenty-eight with Sarah Jennings, the clever, beautiful, imperious attendant and friend of Princess Anne

Churchill was a man of tact, and great military and political talents When the follies and tyranny of his old patron turned all England against James II, Churchill took a leading part in the "Glorious Revolution" of 1688 which made William of Orange king as William III

For the assistance he then gave he was rewarded by being made Earl of Marlborough He was of great service to William III in conquering Ireland, which clung to James II, and as commander against the French in the Netherlands But he was never wholly trusted by the new king, and not without reason, for, while ostensibly supporting William III Marlborough was in correspondence with the exiled James II

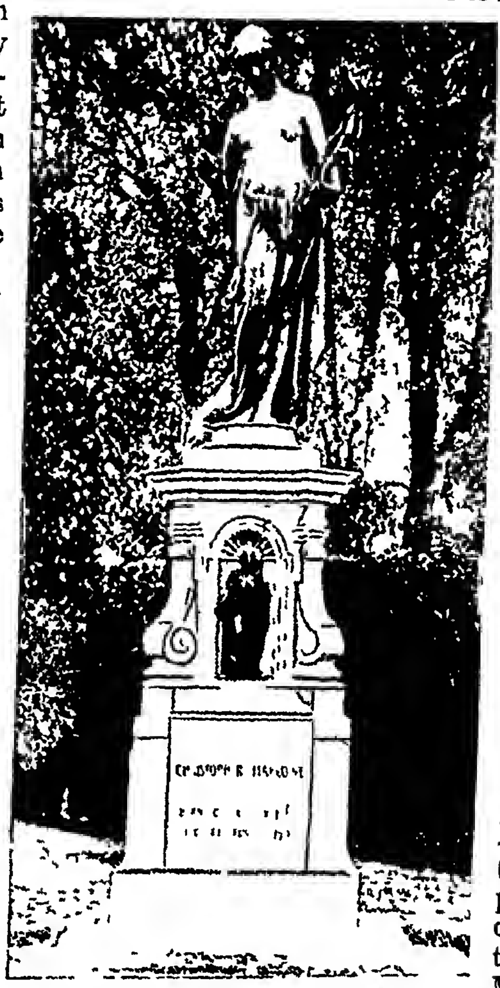
When Queen Anne came to the throne, in 1702, she showered the richest benefits upon Marlborough and his wife These included the title of Duke the position of commander-in-chief of the English forces, and the chief influence in the government His abilities, however, were equal to his opportunities A Frenchman once said that he never besieged a fortress that he did not take, never fought a battle that he did not win, and never carried on a negotiation that he did not bring to a success ful close

During the War of the Spanish Succession that ran its course from 1702 to 1713—in which England's chief interest was to prevent France from obtaining Spain, with its vast colonies and dependencies—Marlborough showed his unrivalled generalship in some of the greatest campaigns in English history On August 13, 1704, as commander of the Dutch and English forces, acting with Prince Eugene of Savoy, the Austrian commander, he won a great victory over the French at Blenheim (q v), in southern Germany This battle stamped Marlborough as the first general in Europe It broke the spell surrounding the great power of France under Louis XIV, and ensured the continued exclusion of the Stuart line, descended from James II, from the English throne The victory also helped to lay the basis for English rule both in North America and in India Hence the battle of Blenheim has rightly been included by the historian Creasy among the decisive battles of the world

In 1706 the battle of Ramillies, in 1708 that of Oudenarde, and in 1709 Malplaquet, continued Marlborough's career of victory And as a result of these victories England was able to negotiate the profitable Peace of Utrecht in 1713, which gave Europe peace for 30 years

Marlborough, however, had fallen from power before this treaty was negotiated The Queen had at last grown heartily tired of the tyranny of his wife, and threw off her yoke Then Marlborough's enemies succeeded in having him dismissed from power This was in 1711

When George I came to the throne in 1714 Marlborough was restored to his military posts He died June 16, 1722, and was buried with great splendour in Westminster Abbey Later his remains were removed to the chapel at Blenheim, the magnificent palace erected for the Duke, near Oxford, at the nation's expense, before his fall from favour



MEMORIAL TO MARLOWE
This monument in Canterbury was erected to Christopher Marlowe's memory in 1891, when Sir Henry Irving unveiled it near the Cathedral It now stands in the Dane John The small figures in niches round the plinth represent the plays, the one visible here being Tamburlaine
Photo Barratt

Marlowe, Christopher (1564–1593) Before he perished tragically in a drunken brawl at the age of twenty-nine, Christopher Marlowe had written some lines that are among the glories of English literature

Born February 6, 1564, at Canterbury, where his father was a shoemaker, he passed from the local school to Corpus Christi College, Cambridge, where he graduated Little is known about his career after he left the University, except that he was friendly with Shakespeare and other leading men of letters

His earliest drama, "Tamburlaine," was written in 1587, followed by "The Tragedy of Dr Faustus" (1588), "The Jew of Malta" (1590), and "Edward II" (1593) He also wrote several translations, and composed original poetry

Marlowe in his dramas handled English in a way that had never been attempted before There is no earlier author who writes such deep, resounding, sonorous verse, and of later writers

Shakespeare alone surpasses him in poetic feeling and dramatic power

Unfortunately Marlowe, like many brilliant young men, was a rebel—he held views which were regarded by the authorities as dangerous In 1593 the Privy Council issued a warrant for his arrest Marlowe learned of this in time to escape, and reached the little village of Deptford, three miles from London But there he became involved in a quarrel, and was stabbed to death

Marquette, JACQUES (Pron mar-ket') (1637–1675) On the white beach of St Ignace, where the Strait of Mackinac connects the waters of Lake Huron and Lake Michigan, Father Marquette, a French Jesuit, blessed his people before he and his companion, Louis Joliet, stepped into their birch-bark canoes and started on a long voyage of discovery At once they bent to their paddles, only pausing as they rounded the point to wave a last farewell

That was on May 17, 1673 Paddling along the shore, they entered Lake Michigan and safely traversed the wind-tossed waters of Green Bay to Fox River Ascending that river to near its source, they carried their canoes across country for about 50 miles to the Wisconsin River

For seven days the paddles drove the light canoes down the river Upon the morning of the eighth day (June 17) the waters widened and the voyagers suddenly paddled into the muddy current of the mighty stream of which they had heard—the *Missi-sepi*, or Great River They were the first white men to behold the Mississippi since De Soto discovered it 130 years before

On July 17, fearing capture by the Spaniards, the explorers turned back At the end of September they reached Green Bay, having been travelling for five months, during which time they had covered more than 2,500 miles

Marriage. When we say that Mr Smith and Miss Brown have got married, we mean that in church, chapel, or registry-office they have publicly agreed to live together as husband and wife It is understood, of course, that neither is already married, that is, has a spouse living from whom the other has not been divorced Going through a marriage ceremony when one already has a husband or wife living is called committing bigamy, and is a crime

This form of marriage, the marriage of one man and one woman is called *monogamy*, and we are accustomed to think of it as the highest and latest type, since it is practised by the most advanced peoples of today

But in many parts of the world not monogamy but *polygamy* is the custom In Old

Keystone

A MARRIAGE CUSTOM OF OLD JAPAN

When a marriage is contemplated in Japan the matter is placed in the hands of a professional "match-maker or marriage-broker He arranges for the young couple to meet in a tea-house, the favourite meeting-place for everyone in Japan and there makes the arrangements If the pair like each other well enough, the bride-to-be serves her future husband a ceremonial cup of tea which is seen being drunk in this photograph as a token of their marriage

Testament times this was the common practice of the Jewish people, and the closely-related Arabs have retained the custom of having several wives Practically all Arabs are Mahomedans, and each member of that faith is allowed four wives

Throughout the greater part of Africa wives are considered as part of a man's wealth He pays a price for a woman and she then becomes his possession If he has many wives, they cultivate his land, attend to his animals, and look after the household The importance of a native chief may be measured by the number of women in his family

Polygamy is recognized in India, China, and many portions of the Orient, but usually is restricted to the wealthier classes It was practised also by some American Indian tribes, and to a slight extent by the Mormons until it was prohibited by the laws of the United States Closely related to polygamy is a system known as *concubinage*, in which a man possesses many women who are not considered as wives and whose children usually do not share in property left by the father

The possession of two or more husbands by one woman, called *polyandry* (from the Greek words for "many" and "men"), is less common than either of the two forms of marriage already discussed, but is found in widely-separated areas, notably in Tibet, in Southern India, and in some Eskimo groups In polyandry the wife usually maintains the family household, and her husbands take turns living in her home The wife designates which husband is to be considered "father" of each child Each child receives support from its appointed father, but does not inherit his property

Marrows AND PUMPKINS These plants and their allies are members of the same great family, the *Cucurbitaceae*, which flourishes especially in tropical regions One well-known member, described under its own name, is the cucumber (*Cucumis*), to whose genus also belongs the melon But the marrow is really the typical member of the family, belonging to the genus *Cucurbita*, together with the pumpkin (*C pepo*), which we grow sometimes in this country under the name of "squash"

Vegetable marrows grow to a great size, as you can see for yourself if you visit any village flower-show in the summer, for it is almost traditional to find a prize for the biggest vegetable marrows—giants often weighing as much as fifty pounds, but consisting very largely of water! It is said that to grow one of these vast vegetables, you should keep the tip of the marrow in water, as it then swells and swells Marrows have the further advantage that they may usually be grown on any heap of old rubbish so long as there is a good deal of nourishment, and the garden manure heap is an ideal situation The flowers are rather handsome, being large, trumpet-shaped, and bright yellow or orange, and the straggling stems bear great rounded leaves, whose main veins are armed with spines or hooks, as are the stems themselves

B A Malby

VEGETABLE MARROWS

Nestling beneath the big leaves of their luxurious plants, these marrows, white and dark green, are as perfect examples as the gardener could wish to grow Marrows flourish out of doors, especially when supplied with plenty of water and manure

In England we have one wild member of this family, the white bryony (*Bryonia dioica*), whose straggling, half-climbing stems and tough, lobed leaves are characteristic of the group Its flowers are whitish-green, and the fruits are bright red berries This is no relation of the black bryony, a member of a quite different group One remarkable member of the family is the "squirting cucumber" (*Ecballium*), from the fruits of which the seeds, when ripe, are ejected with considerable force

Marrows and pumpkins are good to eat, and, when quite ripe, they may be made into jam Unripe marrows are usually green or yellowish, when ripe, some shade of orange

Marryat, FREDERICK (1792–1848) Few people, at some time of their life, have not been thrilled by Captain Marryat's vigorous stories of the sea with their inimitable accounts of fights, chases, and adventurous expeditions Many a schoolboy might well envy the life of this sailor-novelist, for previous to settling down to writing his numerous stories of nautical life he passed many years of exciting and dangerous service in the Navy

Marryat was born at Westminster on July 10, 1792, and as a child he tried several times to run away to sea In 1806 his father entered him as a midshipman in the Navy He saw a

great deal of service, both in European and American waters, before the peace of 1815 He held a command during the Burmese War of 1824–25, and retired in 1830

His works won remarkable popularity both for their inventiveness and characterization, especially among people who love adventure but have not the opportunity to experience it themselves The best of Marryat's books rank as classics in English literature, in which he stands as an important historical figure, handing on the novel-tradition of Smollett to Dickens

FREDERICK MARRYAT

A novelist who deserves to be read more—and the author of many thrilling stories—Marryat occupies an important place in English literature, as a "connecting link" in the novel's history between the 18th and the 19th centuries

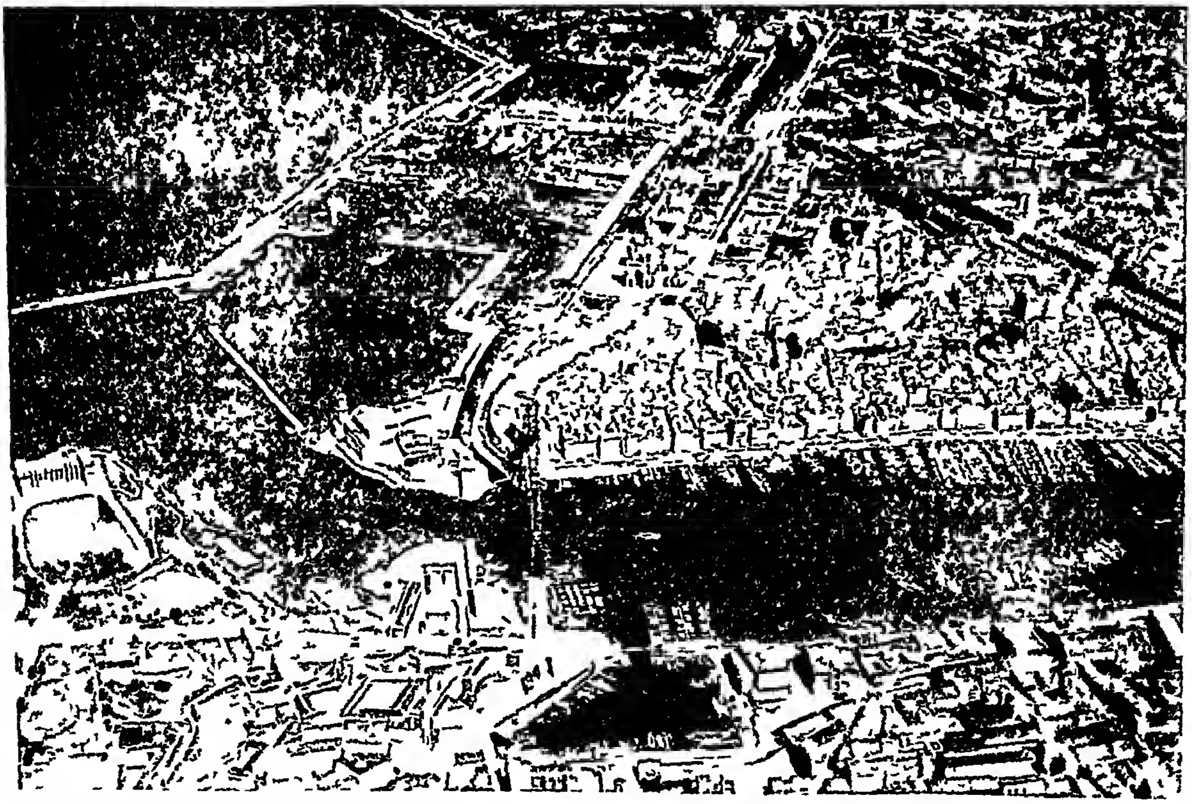
Marryat's chief works are "Frank Mildmay," 1829, "Peter Simple," 1834, "Mr Midshipman Easy," 1836, "Japhet in Search of a Father," 1836, "Masterman Ready," 1841, "The Settlers in Canada," 1844, and "The Children of the New Forest," 1847

Mars. Next in importance to Jupiter in the Roman religion was Mars, the god of war He was regarded as the father of the Romans through his son Romulus, the legendary founder of Rome, and was worshipped with great honour He was in early times also a god of Nature and fertility The month of March (Latin, *Martius*) was dedicated to him

The Greek god Ares is identified with Mars But the Greeks thought of Ares only as a sender of war and pestilence, a quarrelsome god, delighting in the slaughter of men and the destruction of cities He was not widely worshipped in Greece, though the Areopagus, the sacred hill of Athens, was named from Ares

In astronomy the name Mars is given to the fourth planet in order from the sun—supposedly because of its red and angry countenance (*See* Planets and the plate facing page 324)

Marseilles, (Pron mar-sālz'), FRANCE In the sunshine on the shores of the Mediterranean lies the second city of France—romantic, busy Marseilles It is the greatest seaport of France, and in the harbour, which was enlarged



THE BASINS AND OLD HARBOUR OF MARSEILLES *Aerofilms Ltd*

In this magnificent air view of the dockland of Marseilles we can see why it is the principal seaport of France, for every bay and wharf is thronged with vessels large and small On the left of the upper half of the picture are the basins, in the centre is the cathedral, with its six domes, and the water running inland at the bottom is the Old Harbour, crossing the mouth of which the Transporter Bridge can be seen

in 1933, when the canal to Arles was completed, ships from all parts of the world can be seen

South-west of the harbour lies the tiny island called Château d'If, made famous by Dumas' story, "The Count of Monte Cristo" Inside its walls many German spies were confined during the World War

Marseilles is the headquarters of the trade with the East and the French colonies in North Africa, but long before there was any nation called France, Marseilles traded with strange and distant lands It was founded, under the name of Massalia, by Greek settlers from Phocaea, in Asia Minor, about 600 B C After the decline of Greece its people sided with Rome against Carthage, Massalia's rival in commerce But later the Massalians made the mistake of helping Pompey against Caesar and the city was severely punished

Marseilles (in French, *Marseille*) was Christianized in the 3rd century, and its first martyr was St Victor, a Roman soldier put to death in the persecutions of Diocletian Through the Middle Ages it was part of the region called Provence, and it had varied experiences, including capture by the Saracens in 735

The surroundings of Marseilles were arid until 1848, when a canal was completed which brought to it the waters of the river Durance In the last sixty years the city has grown rapidly as a result of the opening of the Suez Canal Today there is no city in the world more entitled to be called "cosmopolitan" than Marseilles In its famous Rue Cannebiere one may meet at any time, night or day, people of all nationalities talking many tongues and wearing all manner of picturesque garbs High above the city, commanding a very wide view, stands the famous church of Notre Dame de la Garde, which forms a conspicuous landmark for sailors far out at sea The chief industries are the making of soap, olive and other oils, and miscellaneous manufactures The population of Marseilles is about 914,000

Marsupials. These animals are so named from the Latin word *marsupium*, meaning a pouch, on account of the curious pocket in which they keep their young In former ages marsupials were met with all over the earth, but today they are found chiefly in Australia Besides the kangaroo, the principal marsupials of Australia are the bandicoot, wallaby, cuscus, opossum or phalanger, banded ant-eater, Tasmanian wolf or thylacine, Tasmanian devil, and certain pouched dog-like and bear-like animals such as the koala and wombat, most of these are described under their own headings in other pages of this work

They show a wonderful range of forms, equivalent in many ways to all the groups of mammals found elsewhere

Outside of Australasia, the only marsupials which now exist are the opossums, found in South America and the southern parts of the United States (*See also* Australia)

Frances Pitt

RARE PINE MARTEN

One of the rarest of our British wild animals, and in many parts now extinct, the pine marten is a large, tree-haunting relative of the weasel, as its sharp snout, intelligent look and long, slender body show It is trapped both for its fur and because of the damage it does to game preserves

Marten. The sable, the most aristocratic member of this branch of the weasel family, furnishes the most expensive of all furs A single skin of "Russian sable" of fine quality is worth £500 or more, a coat of this dark lustrous fur has sold for £15,000 Sable fur is so fine and even that each single hair tapers gradually to a point, that is why sable brushes are the best for painting Even these brushes, made of hair taken from the least desirable skins, are very expensive

Martens have long slender bodies and short legs, and live mostly in trees, leaping from one to another like squirrels Their outer fur is long and glossy, with an abundant, soft under-fur

The European pine marten, *Mustela martes*, is the only species that occurs in the British Isles, where it used to be common, but is now confined to the wilder regions, for it has been much persecuted as injurious to game The beech marten or stone marten is another variety, with hair inclined to greyish-brown and pure white on the breast It is found in most parts of Europe south of the Baltic, and also in Asia

The American species include the Canadian sable, which is about the size of the large house cat It has a soft deep fur of rich brown, lighter-coloured below with a tawny spot on the throat, which is largely used as a substitute for Russian

sable Another is the fisher marten, black marten, or pekan, as it is variously called, the largest of the group It is from 2 to 3 feet long, with a bushy tail a foot or more in length, greyish-brown, with dark markings, it has the tail tipped with black

Martinique. (Pron mar-ti-nēk') Tourists who visit Martinique, one of the small group of island colonies of France in the West Indies, find two spots of great historic interest The first is the ruins of the quaint old house in which the unhappy Empress Josephine, Napoleon's wife, was born The other is the scene of desolation which marks the site of the once beautiful St Pierre the city which was totally destroyed in 1902 by the eruptions of Mont Pelee, when its "flaming geyser" of molten lava and poisonous gases killed nearly forty thousand people

Mont Pelee, about 4,900 feet high, is the highest point in a lofty, thickly-wooded mountain ridge, which gives to the hot, rainy little island most of its picturesqueness Of volcanic formation, Martinique is irregular in shape, with indented coasts, high and rugged Its area is 385 square miles, the capital is Fort de France (population, about 43,000)

THE FIRST CHRISTIAN MARTYR

Brought to trial Stephen made a speech (reported in Acts vii) and "when they heard these things they were cut to the heart, and they gnashed on him with their teeth And cast him out of the city, and stoned him And he cried with a loud voice, Lord lay not this sin to their charge And when he had said this he fell asleep"

Painting by Sir John Millais Tate Gallery photo Mansell

Somewhat more than a third of the island is under cultivation Sugar, rum, cocoa, coffee, tobacco and cotton are the leading products The farms are served by well-built roads, and some of the sugar cane plantations have little railways of their own

Martinique was discovered by Columbus in 1502 It was colonized by the French in 1635 They have held it since that time, save for three occupations—in 1762, from 1793 to 1801, and from 1809 to 1814—by the British The island is controlled by a Governor and General Council The population of about 234,000 consists chiefly of negroes and half castes, the whites amounting to only about 3 per cent of the total

Martyrs, CHRISTIAN "The blood of the martyrs," wrote one of the early Christian Fathers (great ecclesiastical writers of the first centuries of the Christian era), "is the seed of the Church" For by the heroic courage with which they endured persecution and died for their faith, they won thousands of converts, and so Christianity triumphed over paganism

"Martyr" comes from the Greek and means a "witness" Stephen, who was stoned to death in the days of the Apostles (*see* Acts vii) was the first of the Christian martyrs Altogether about 14,000 martyrs are included in the records of the Roman Catholic Church Among the most famous are St Lawrence, who is said to have been roasted on a gridiron about the year 258, during the persecution of the Emperor Valerian, and St Sebastian, a captain of the Praetorian Guard under Diocletian, who was condemned to be shot by a troop of archers for his faith Sebastian's martyrdom has been a favourite subject with painters, who represent him as a

beautiful youth bound to a tree and pierced by countless arrows In 1563 an English clergyman named John Foxe published a "Book of Martyrs" commemorating those who had died for Protestant beliefs, particularly during the reign of the late queen, "Bloody Mary"

Marx, KARL (1818–1883) A brilliant youth, the son of a prosperous Jewish lawyer in Trier (Treves), in the Rhineland, Karl Marx as a German university student was expected to win success in his father's profession But his mind wandered away from his study of law to brood upon social and economic problems, and so he became the founder of modern Socialism

"Why are the workers the poorest of all classes of people?" he asked himself "Wealth is the product of their labour, yet of this wealth they receive scarcely a sufficient share to maintain life The balance goes to those who command their labour, the Capitalists The Capitalist class, then, is enriching itself by withholding from Labour part of its rightful share." Reasoning in some such manner as this, Marx finally came to the conclusion that there was an inevitable conflict between Labour and Capital All through history, as he saw it, this class struggle had been going on and he believed that the struggle must continue until the workers won the "instruments of production" and established the Socialist state

E N A

KARL MARX

Karl Marx's writings have had a profound influence on modern political thought, and the Communist and "left-wing" Socialists' creed is based on his criticism of the capitalistic methods of production The measures adopted by Lenin in establishing the Soviet Republic in Russia were also based on the teachings of Marx

These principles were first clearly formulated in the "Communist Manifesto" drawn up by Marx and his friend, Friedrich Engels, as the programme for the Communist League which met in London in 1847 This famous document, with its rallying cry, "Working-men of all countries, unite!" marks the beginning of the modern international Socialist movement

Karl Marx had passed through many hard experiences, and there were further trials in store for him He had been editor of a paper in Germany which was suppressed He then went to Paris, but was expelled from France within two years, and sought another home in Brussels Meantime he had married Jenny von Westphalen, who, though of gentler birth than himself and reared in luxury, cheerfully shared the poverty which was often to bring them and their children to the verge of starvation During the attempted Revolution of 1848 Marx returned to Germany, but was ordered to leave in 1849 He then settled in London, where he remained to the end of his life Most of his days were spent in the reading-room of the British Museum

His death, hastened by overwork and by sorrow over the loss of his wife, came before he had finished his great work on political economy entitled "Das Kapital" (Capital) This book, completed and edited by Engels, has been called "the Bible of Socialism" It is based on the so-called "materialistic" or "economic" view of history, which emphasizes the idea, as Engels puts it, "that first of all men must eat, drink, have shelter and clothing, and, therefore, must work before they can struggle for supremacy and devote themselves to politics, religion, philosophy, etc," and that, therefore, the social and political ideas and conditions of a time are determined by economic conditions Marx thought that the Capitalistic era of production had played a necessary part in social development, but that, having reached its highest point, it must, he claimed, be followed by another order His system is often called "Scientific Socialism" as opposed to the earlier "Utopian Socialism," which sought to bring about its ends without reference to the difficulties involved Unlike the Utopians, Marx looked for no sudden change to an ideal state, neither did he seek to overthrow governments by violent means

Mary. QUEENS OF ENGLAND In the long list of rulers of England women appear only five times, and two of these five bear the name Mary

MARY I, called Mary "the Catholic" or Mary Tudor, reigned from 1553 to 1558 She was the daughter of Catherine of Aragon and Henry VIII, and was born in 1516 At first she was a favourite with her father, but when none of Catherine's other children lived, and this homely, sickly daughter was left as his sole heir, he grew to dislike her During the rest of his life, and that of Edward VI, Mary was harshly treated, for she clung to the Catholic Church with the same loyalty that she had shown to her mother

When her young brother died, almost all England rejoiced that the attempt to put Lady

Jane Grey in Mary's place as the heir was defeated. Indeed, at her accession Mary was one of the most popular rulers that England ever had, though before the end of her reign she had come to be one of the most hated.

In part, her loss of popularity was due to her marriage with Philip II of Spain, the champion of the Catholic party in Europe. Englishmen disliked this marriage, partly because they did not like foreigners, but still more because they feared that it would force England to take an active part in the wars between France and Spain. These fears were justified, and in the struggle England lost Calais, which had been an English outpost since the days of Edward III. This was a great grief to Mary, who declared that when she was dead the word "Calais" would be found graven on her heart.

CATHOLIC AND PROTESTANT MARYS WHO RULED ENGLAND

Known for her persecutions of Protestants as "Bloody Mary," Queen Mary I (left) was a much misunderstood character, for though she loved Rome she loved England more, as her remark on the loss of Calais shows. Mary II (right), the daughter of James II and wife of William of Orange, on the other hand, was a devoted Protestant, to which fact, indeed, she owed her throne.

From paintings in the National Portrait Gallery

When Mary married, the Catholic religion was restored. The rigour exerted against the Protestants has been attributed to animosity on Mary's part, but it was only to be expected that the old religion would be carefully guarded, and to do this the laws against heresy were revived, for the hostility to Catholicism frequently became a danger to the public peace. Because of the many Protestants who were burned at the stake or otherwise executed during her reign, she is sometimes styled "Bloody Mary."

In the midst of it all, Mary herself—childless, sick, neglected by her husband, and one of the saddest figures of that age of conflict—died, realizing the fruitlessness of her efforts.

MARY II (1662–1694) was the elder daughter of James II by his first wife, Anne Hyde, and in 1677 married William, Prince of Orange, Stadtholder of Holland. When the revolution of 1688 drove her father from the throne, William of Orange and Mary were invited to become joint sovereigns, and, though torn by conflicting loyalties, Mary threw in her lot with her husband (*see* illus. page 1528). The administration was left in the hands of her husband, William III, but it was Mary who made the reign popular by her youth, good heart, pleasing manners, and her staunch adherence to the Protestant faith. At her death from smallpox, after a reign of only six years, leaving no children, William III had a much more difficult task to face than when aided by his wife.

Mary, QUEEN MOTHER (born 1867). No Queen Consort in English history has been better beloved by the people than Queen Mary, and none has had greater influence for good on the social conditions of her time.

Queen Mary was born at Kensington Palace, May 26, 1867. She was the eldest child and only daughter of the Duke of Teck and his wife, Mary, a daughter of the first Duke of Cambridge and a granddaughter of George III. The Princess was baptized Victoria Mary Augusta Louise Olga Pauline Claudine Agnes, and was known in the home circle as May.

In 1891 the Princess Mary was betrothed to the Duke of Clarence, the heir, after his father, the Prince of Wales, to the throne. He died, however, on January 14, 1892. On May 3, 1893, the engagement of the Princess and his brother, the Duke of York, was announced, and the marriage was celebrated on July 6, 1893, in the chapel of St. James's Palace. The Duke and Duchess lived at York House, London, and York Cottage, Sandringham. Her husband was made Duke of Cornwall on his father's accession in 1901, and in November of the same year he was made Prince of Wales.

As Princess of Wales Queen Mary became widely known to the country by her performance

of many public duties She accompanied her husband on his tours in the Dominions and India She became Queen Consort in 1910, and was crowned in Westminster Abbey on June 22, 1911, and in December of the same year was crowned Empress of India at Delhi

During the World War Queen Mary did invaluable work for the women's organizations She started in August, 1914 the Queen's Work for Women Fund, to provide employment for women made workless by the War, and in the same month inaugurated Queen Mary's Needlework Guild, to provide clothes for those made destitute by the War She was a constant visitor to War hospitals, and accompanied King George V on his visits to the front to visit the wounded in France and Flanders When the year of mourning for King George V had expired Queen Mary once more devoted herself to helping by her interest and practical knowledge of social conditions every movement that makes for the betterment of the people

Queen Mary has always combined in a unique degree the domestic virtues of a good wife and mother with the keenness of intellect as well as the dignity required for her station in life, and she will afford for all time a perfect example of what the wife of Britain's king should be

MARY THE QUEEN MOTHER

Equally with King George V, Queen Mary shared in the love and loyalty of the whole Empire—especially, perhaps, at their Silver Jubilee celebrations in 1935 Her dignity and true queenliness set a high standard and example for her successors and her subjects

Photo Hay Wrightson

Mary Stuart, Queen of Scots (1542–1587) It was with tears and heart-broken cries of farewell that Mary Stuart set sail from France for Scotland A girl of 19, returning like an exile from Paradise to a childhood home for which she had not a single affectionate thought—a queen approaching her throne as Cinderella might have crept back to her ashes!

Mary, the daughter of James V of Scotland and the French princess, Mary of Guise, was born December 8, 1542 Seven days later the king died, leaving Scotland and its infant queen as prizes to be fought over, not only by England and France, but also by Scots lords and clerics The English demanded that the baby queen should be pledged to marry Prince Edward, heir to the British throne, but the Scots decided to maintain the alliance with France, and chose the French heir as the future husband of the infant Scottish queen

Married to the Dauphin in 1558, at the age of 15, Mary became queen of France, as well as of Scotland, when her husband ascended the throne as Francis II in 1559 A year and a half later she was left a childless widow, and left the dissolute court of France

But the Scotland to which she returned was very different from the one she had left Her mother, who had acted as regent, had just died, the French interest had waned as the English power under Elizabeth had grown, and the Protestant Reformation, for which John Knox and others had long laboured, was now established Mary looked upon Protestant Scotland as no more than a pawn to be used in strengthening her position in England for as granddaughter of Henry VIII's elder sister, Mary was heiress to the crown of England if, as might be expected, Queen Elizabeth should die without issue Mary's second marriage, in 1565, to Lord Darnley, who also had pretension to the English crown, was meant to strengthen this claim

But Darnley's weak insolence and Mary's staunch attachment to Catholicism produced discord between her and her Protestant subjects Darnley's natural jealousy was fostered by many Scots lords, Mary's enemies, who pointed to the rapid advancement with which the queen favoured her low-born Italian secretary, David Rizzio Darnley became a party to a conspiracy of nobles, which resulted in Rizzio's murder in Mary's presence The queen pretended to pardon Rizzio's murderers, and even flattered Darnley into complete reconciliation On June 19, 1566, Mary's son—afterwards James VI of Scotland and James I of England—was born Then in February 1567 she induced her husband, who was ill with smallpox, to take up his residence in a house called Kirk of the Field, near Edinburgh One night the house

MARY OF SCOTLAND SAYS FAREWELL TO FRANCE

After the death of her husband, King Francis II of France, Queen Mary reluctantly gave up the gay life of the French court to return to her troubled throne in Scotland We see her here on shipboard gazing sadly at the receding shores of the land she loved so well It seems as if the artist sought to show that the unhappy queen already had a presentiment of the tragedies that were soon to overwhelm her

MARY STUART FACES HER FAVOURITE'S MURDERERS

Although Mary's Italian secretary, David Rizzio, had always been his devoted supporter, the foolish Lord Darnley, Mary's second husband, was persuaded that the Italian was stealing the Queen's heart, and helped to plan the murder of Rizzio On March 9, 1566, a party of Darnley's supporters burst into the Queen's room at Holyrood Palace, seized the terrified secretary, and dragged him outside to his death The murderers were outlawed, and Darnley, a year later, was himself murdered

From a painting by Eugene Siberdt

was blown up and Darnley's murdered body was found near by the next morning

Suspicion against the queen flared into open denunciation and scandal when, three months and six days afterwards, Mary was married to the Earl of Bothwell, who had been exposed as the chief of Darnley's assassins "Burn her! kill her! drown her!" rang through the streets, and a rebel army took her prisoner at Carberry Hill While Bothwell fled to Denmark, she was forced to abdicate in favour of the boy James Escaping from prison at Loch Leven (May 2, 1568), she hastily rallied around her a little army When this was defeated by the regent Murray's forces at Langside, Glasgow, Mary fled across the English border and cast herself upon the mercy of her cousin, Queen Elizabeth, who promptly made her a prisoner The famous "Casket Letters," said to have been written by Mary to Bothwell, were considered evidence of her guilt, but lately they have been proved to be clever forgeries For the next 19 years Mary's name was constantly involved in plots for escape and for the overthrow of Elizabeth The Babington conspiracy in England was only the last and fatal link in a series which at length induced Elizabeth to bring Mary to trial She was convicted of complicity in the plot for Elizabeth's assassination So long as Mary lived there could be no safety for Elizabeth, and at last she was prevailed upon to sign the death-warrant On February 8, 1587, Mary Stuart, arrayed in black velvet and bearing herself as befits a queen, was beheaded in Fotheringay Castle

"Cease to lament," were her last words to her weeping attendants, "for you shall now see a final end to Mary Stuart's troubles I pray you take this message when you go—that I die true to my religion, to Scotland, and to France" So ended in grim tragedy one of the stormiest and yet most romantic and fascinating careers known to history

Maryland, U S A One of the thirteen original states of the American Union, Maryland has Pennsylvania on the north and Delaware on

the east The western boundary is Virginia, and on the south is the Atlantic Ocean The state has a land area of 10,941 square miles and a water area of 2,386 square miles Annapolis, the capital (named after Queen Anne), has a population of 12,500 Here is the U S Naval Academy The largest city and the most important manufacturing and commercial centre is Baltimore (*q v*), Cumberland and Hagerstown are the next largest cities Maryland embraces the District of Columbia, the seat of the U S government at Washington

Along Chesapeake Bay and the river Potomac lies a low tidal region, which rises to a central hill or "piedmont" region, and ultimately to the Blue Ridge and Allegheny Mountains Chesapeake Bay divides the state into two parts

Agriculture is important, fine wheat, hay, fruit, and vegetables being grown The fisheries are valuable, more oysters being taken than in any other state Among mining industries coal mining is the most important Other minerals are potter's clay, fire-clay, marble, and sandstone The manufacture of men's clothing is also a very large industry

In 1632 Lord Baltimore, desiring a refuge for his fellow Catholics, secured from Charles I a grant of lands embracing the present state, which he named Maryland in honour of Queen Henrietta Maria The first colonists landed in 1634 A dispute with Pennsylvania over the northern boundary line was settled in 1763–67 by the survey of Mason and Dixon's Line, which later became famous as the boundary between slave and free states Maryland's sympathies during the Civil War were divided, but, though a slave-holding state, it adhered to the Union The population is about 1,631,500

Masaryk, Thomas Garrigue (1850–1937) One of the most respected statesmen in Europe, Masaryk devoted himself ceaselessly to the political freedom and integrity of the Czechs and Slovaks, and, when independence was achieved, he raised the new state to a position of influence in the councils of Europe His energy of mind and body was unbounded To within a few years of his death his physical fitness was a source of wonder to all, at eighty he could outride many younger men—and could touch his toes without bending his knees He was a man of deep knowledge and an excellent linguist A lover of England, of English people, and of English ways, he delighted in riding on the upper deck of a London bus

Masaryk was born March 7, 1850, at Hodonin, in Moravia, and was the son of a coachman on one of the imperial estates Apprenticed to a locksmith when he was 14, and later assistant to the village blacksmith, by dint of hard study he became a professor in the Czech portion of Prague University in 1882 Elected a member of the Austrian Parliament in 1891, he was conspicuous for his denunciation of the conduct of Serbo-Croat affairs by the Austrians

PRESIDENT MASARYK

"The maker of Czechoslovakia" is Masaryk's title, for throughout his long life he fought for the independence of the Czechs and Slovaks, and led them as their first president to prosperity Here he is seen with his youngest grandson

When the World War broke out Masaryk saw that his opportunity had arrived, and although over 60 he set himself the task of winning independence for his country He travelled widely, visiting Holland, Italy, France, England, Russia, and the U S A in his efforts to arouse sympathy for his countrymen In 1915 he was professor of Slavic studies at King's College, London He then worked in Paris, and was active in gaining the support of the Allies for the Czechs and Slovaks When, in 1918, the Czechoslovak republic was formed, he was called to be president, his position being confirmed by the national parliament on May 27, 1920 He was re-elected in 1927 and again in 1934 He died September 14, 1937 His son, Jan, became Czechoslovak minister in London in 1926 His wife, an American, to whom he was deeply devoted, died in 1923

Masaryk would have been notable for his literary career alone, for he wrote much on philosophical, sociological, and political matters

Masefield, John Edward (b 1875) The life of a poet, you may justifiably think, if not a quiet one, is at least unlikely to have been spent in dangerous places, in sailing the seas, or in "roughing it" in the slums of great cities Yet

this is how a famous poet laureate, John Masefield, spent his early life Born at Ledbury in Gloucestershire, June 1, 1875, he served on the Conway, the training ship for the Mercantile Marine, and sailed round Cape Horn He joined the White Star Line, but abandoned a sailor's life when he reached the U S A, where in varied employments he gained hard experience of the lower strata of society All the while he had been practising writing on his own account, and his "Salt-water Ballads" were published in 1902 "A Mainsail Haul" in 1905 and his edition of "Dampier's Voyages" in 1906 enabled him thenceforward to devote himself to a literary career in England (*See* illus page 1537)

Many of Masefield's earlier poems, as seen in the volumes of *1902–05*, and in the "Ballads and Poems," 1910, were marked by the bold rhythms of the Kipling school His reputation was consolidated upon the publication, in 1911, of the first of his long narrative poems, "The Everlasting Mercy," recounting in somewhat rough-and-ready verse the story of a village drunkard's conversion It was followed by similar works, unequal but vivid in style "The Widow in the Bye-Street," 1912, remarkable for its stark realism and haunting pathos, "The Daffodil Fields," 1913, and "Dauber," 1913 Masefield was, in 1912, awarded the Edmond de Polignac prize for poetry

"Biography" 1912, one of Masefield's less-known poems, shows the poet concerned with that ceaseless striving after an ideal beauty which forms the subject of the series of grave and highly characteristic sonnets in the volume entitled "Lollingdon Downs," 1917 With "Reynard the Fox," 1919, and "Right Royal," 1920, animated pictures of the sporting life of the English shires, Masefield resumed his earlier narrative genre "Enslaved" was published in 1920, and he was appointed poet laureate, May 9, 1930

Versatile as he was, he also wrote plays, which include "The Tragedy of Nan," a finely dramatic dialect play, 1909, and "The Coming of Christ," which in 1928 was performed on the chancel steps of Canterbury Cathedral But you will best know him by his poems and his novels, mainly about the sea, which include "Lost Endeavour," 1910, "Sard Harker," 1924, "*Odtaa*," 1926, "*The Bird of Dawning*," 1933, and "The Taking of the Gry," 1934

Massachusetts, U S A This is one of the original states of the American Union The area, including the islands of Martha's Vineyard and Nantucket (on which is a famous lighthouse), is 8,266 square miles The capital is the famous city of Boston (*q v*) Other towns are Worcester, Springfield, New Bedford, Fall River, Lowell, Concord, and Cambridge, the last the seat of Harvard University

There are no snow-capped mountains, but the Berkshire hills in the extreme west are among the most picturesque hill regions of America, not unlike the English Lake District There are many rivers, the chief being the Connecticut, Merrimac, Charles, Housatonic, and Hoosac Cape Cod is the most prominent feature of the

A SCENE FROM JOHN MASEFIELD'S MIRACLE PLAY

One of the most memorable works of John Masefield is the miracle play, "The Coming of Christ" It is in the style of the old miracle plays, which were acted in churches in the Middle Ages and were the earliest form of dramatic representation in England "The Coming of Christ" was performed in 1928 in the choir of Canterbury Cathedral, in a beautiful setting in keeping with its simplicity This photograph shows one of the scenes, with angels adoring the infant Jesus

Photo W Fiske Moore

whole Atlantic coast-line For fishermen it is like a great pier from which they may stretch their nets, and for Boston it forms a superb natural breakwater The canal from Cape Cod to Buzzard's Bay has removed the dangers which formerly gave the cape an ill name

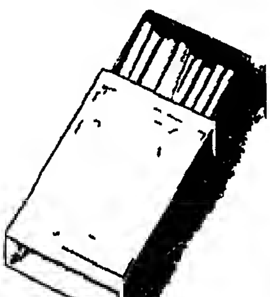
In the second half of the 19th century Massachusetts was transformed from an agricultural to a manufacturing community The industries include the manufacture of boots and shoes, paper, textiles, watches, and machinery Massachusetts' early prosperity came from its fisheries, which are still important

The landing of the Pilgrim Fathers at Plymouth in 1620 marked the beginning of the history of Massachusetts, which was then called Plymouth Colony Many Puritans emigrated here during the reign of Charles I, and Massachusetts became famous for its strictly Puritan laws (the "blue laws") During the reign of Charles II there was friction between the colonists and the Mother Country The Revolution of 1688 in England, however, brought relief The present boundaries of the state of Massachusetts date from 1820 The population of the state today is 4,250,000

LIGHT *and* HEAT *in* YOUR POCKET

The ancient Greeks venerated Prometheus—the giver of fire to Man—as the founder of civilization, and fire was long worshipped as a god Yet today everyone carries this essential to life in his pocket

Matches. A hundred years or so ago it was a solemn thing to watch the father of the family start a fire First of all, he took a little iron box down from the high mantelshelf Inside it were a bar of steel, a flint stone, and a bit of charred linen or "tinder" He struck the steel on the flint and a starry spark flew off on the tinder Slowly the glow spread over the tinder until, by blowing on it and feeding it with shavings and splinters, which were sometimes tipped with sulphur, it at last burst into a flame from which a fire could be lighted It had long been known that phosphorus, sulphur and certain chemical compounds catch fire at low temperatures, but the friction match was not invented until 1827, and the first really practical matches were not put on the market until 1833 For many years most matches were tipped with a mixture of white phosphorus and sulphur, which gave off disagreeable fumes and took fire very easily



Since white phosphorus was found to give off highly poisonous vapours which produce the terrible "phossy jaw" disease once common in the match industry, its use has been prohibited in the leading countries of Europe The inflammable tips now usually contain red phosphorus or a phosphorus compound with other chemicals that promote rapid combustion

"Safety matches," which will not easily ignite except when rubbed against the chemically prepared strip on the side of the box, are usually tipped with quick-burning chemicals such as chlorate of potash, while the phosphorus is in the mixture on the rubbing surface of the box In some European countries "vestas" are much used They consist of thin wax-covered wicks instead of wooden splints

The making of matches is a fascinating process All the work is done by amazing continuous match machines without the aid of the human hand Seasoned blocks of white pine of the required thickness are fed into these machines and turned into matches at the rate of nearly a million an hour

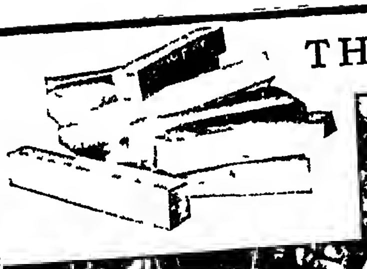
As the blocks are fed in rows of hollow dies gouge into them and thus stamp out the match splints Some machines cut 50 splints at every revolution and revolve 300 times a minute, making 15,000 splints a minute or 900,000 an hour On the upward stroke of the dies the little sticks are forced into holes in drilled metal plates, which hold them tightly Look at a match and you may see the mark of the plate on the lower end These plates are hinged together to form a long endless chain, which carries the splints from one process to another

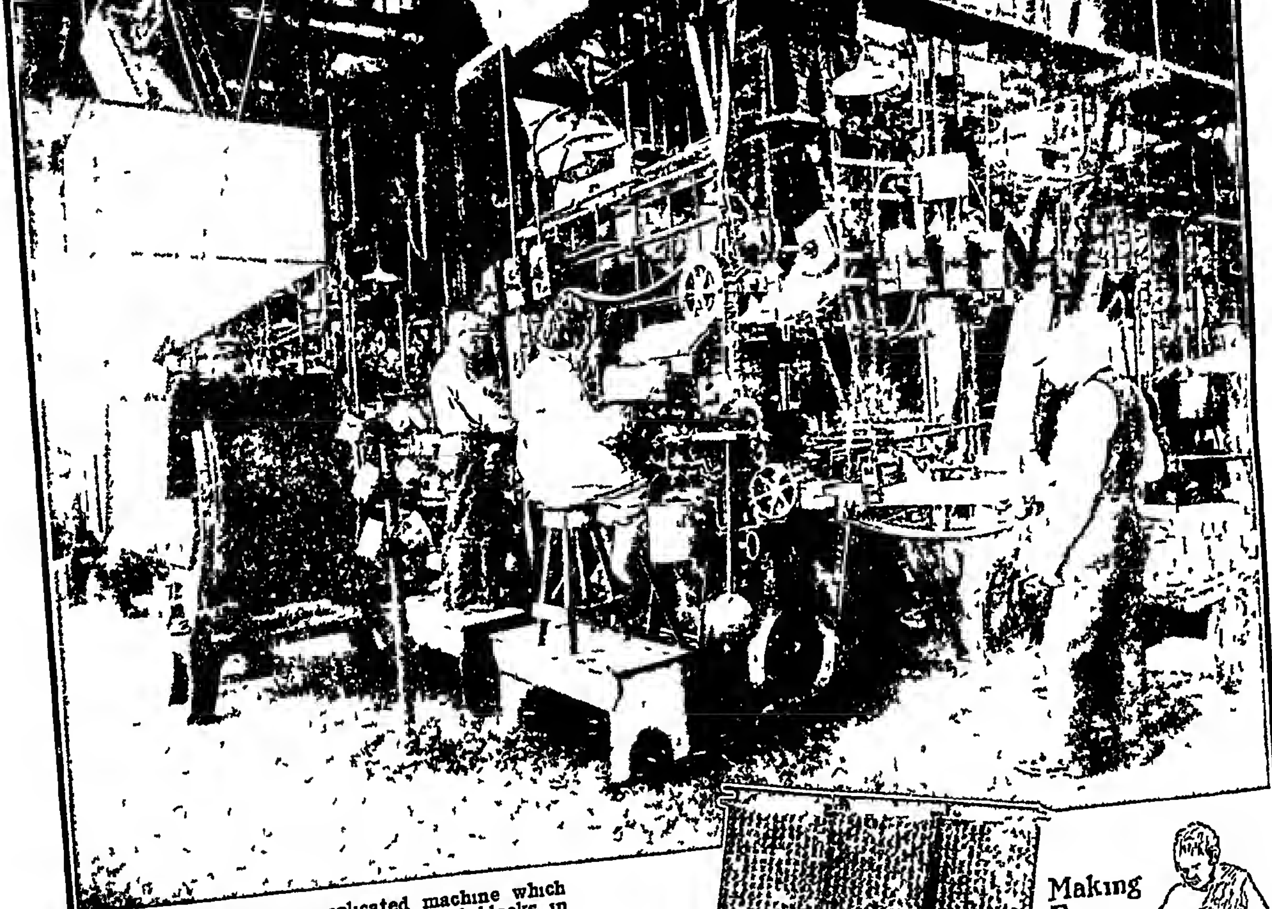
Seven Main Stages in Match-making

First the sticks go into a chemical bath which prevents "after-glow" when the match is burned Then they are dried and carried through a vat of melted paraffin, which makes them burn readily Now they are ready for the head, which consists of two "dips," the first, or bulb dip, containing chemicals that will not ignite under ordinary friction, and the second forming the sensitive tip After being dried by blasts of air the finished matches are pushed out of the plates and packed in boxes by automatic machinery Each box is packed as tightly as possible, usually with 50 matches

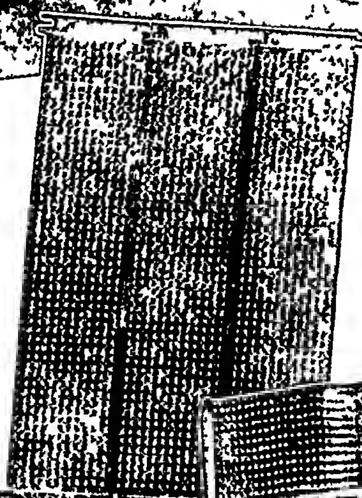
The world uses about eight matches a day for every one of its inhabitants, according to the most reliable estimates About one-third

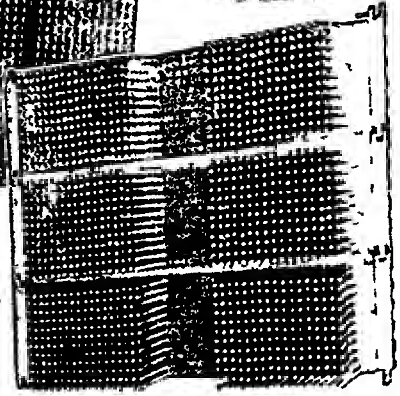
THE MATCH BEGINS ITS JOURNEY



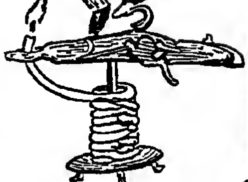


Look at this busy, complicated machine which is cutting match sticks out of wood blocks in the factory of a great modern match company Then look at the little sketch of the savage grunting away as he twirls his bow drill to make a spark of fire Or examine the drawing of the pistol lighter and tinder box, a cranky contrivance in use a hundred years ago Then you will realize what a lot of trouble a match saves us, and how short a time the world has had this great convenience Indeed, many savage peoples today still use the bow drill for making fire As late as 1860 match sticks were made by hand, and the railways were just beginning to accept matches for shipment Before that time matches were always likely to go off like a Roman candle, leaving a bad smell of sulphur behind The picture of the pile of wood blocks in the upper left-hand corner shows how the wood is prepared before it is fed into the machine in the large picture This machine not only cuts the blocks into match sticks at very high speed but plants each of them endwise in a sieve-like plate of metal, full of little round holes just the right size to hold the matches firmly If you examine some makes of matches intended for kitchen use you will notice the mark at the end of each match where it was held in this device The photographs at the lower right show two of these plates, one empty, the other full of match sticks ready to ride along through the giant machine





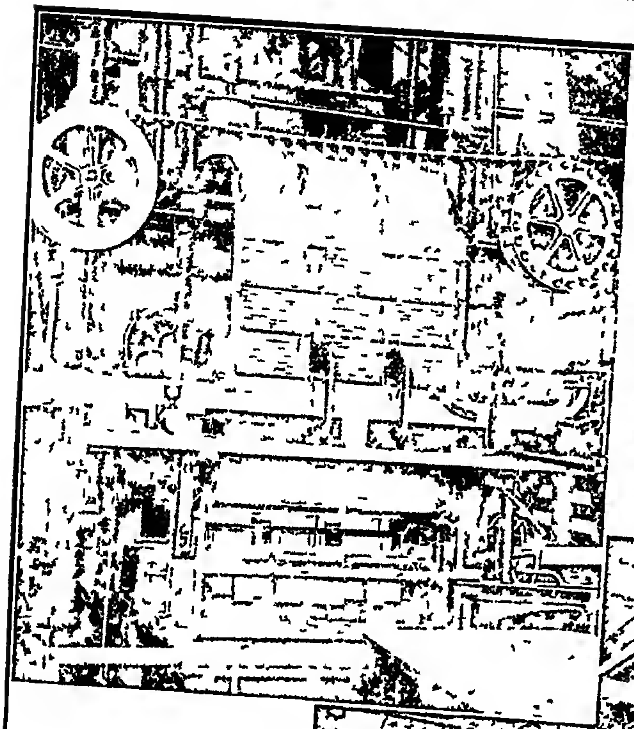
Making Fire with Bow Drill



Pistol Lighter *and* TinderBox

The old pistol lighter at the right was a great convenience in the days before matches were invented Pulling the trigger released a mechanism which turned a grooved steel plate against a flint, producing sparks to ignite the tinder

WHERE THE SPLINTS ARE DIPPED AND TIPPED



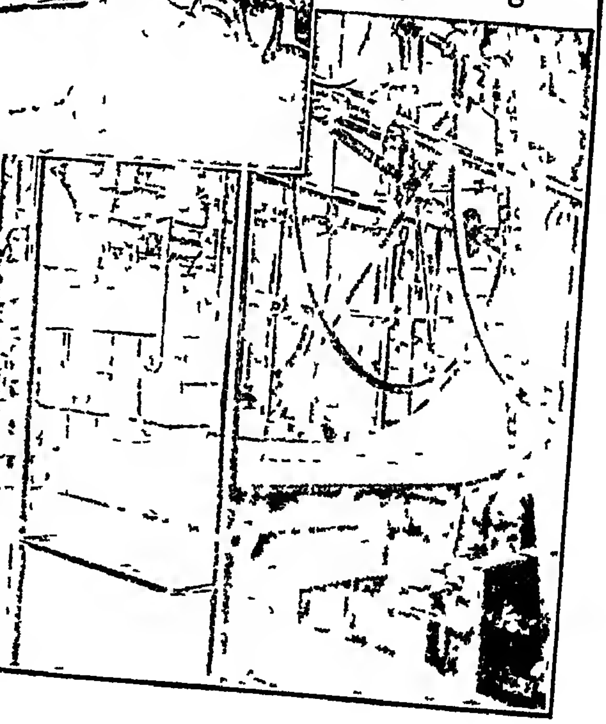
After the crunching knives of the splint-cutting machine have done their work, the matches stand up on end in the metal plates like little forests, as we see in the picture on the left These plates, hinged together in an endless chain, carry the matches first to a chemical bath which treats the wood so as to prevent after-glow when the match is burned Then they are dried and carried on through another bath of paraffin, to make them catch fire readily The boy in the little sketch at the left, who so patiently chopped splints by hand only a few decades ago, never heard of either of these devices for making a well-behaved match In the long rows of big "gipsy-kettles" in the centre picture are cooking the preparations used in tipping the match Nearly a hundred ingredients go into this "brew," the materials being ground in big mills under expert supervision This part of the process of making matches is the most complex, and requires several hours to complete It is no simple, soup-stirring trick, as it was in the old days when the boy in the sketch worked at the dangerous job The fumes from his kettle were a serious menace to his health, for he might contract "phossy jaw," a horrible disease which modern methods and scientific research have entirely eliminated

Boiling

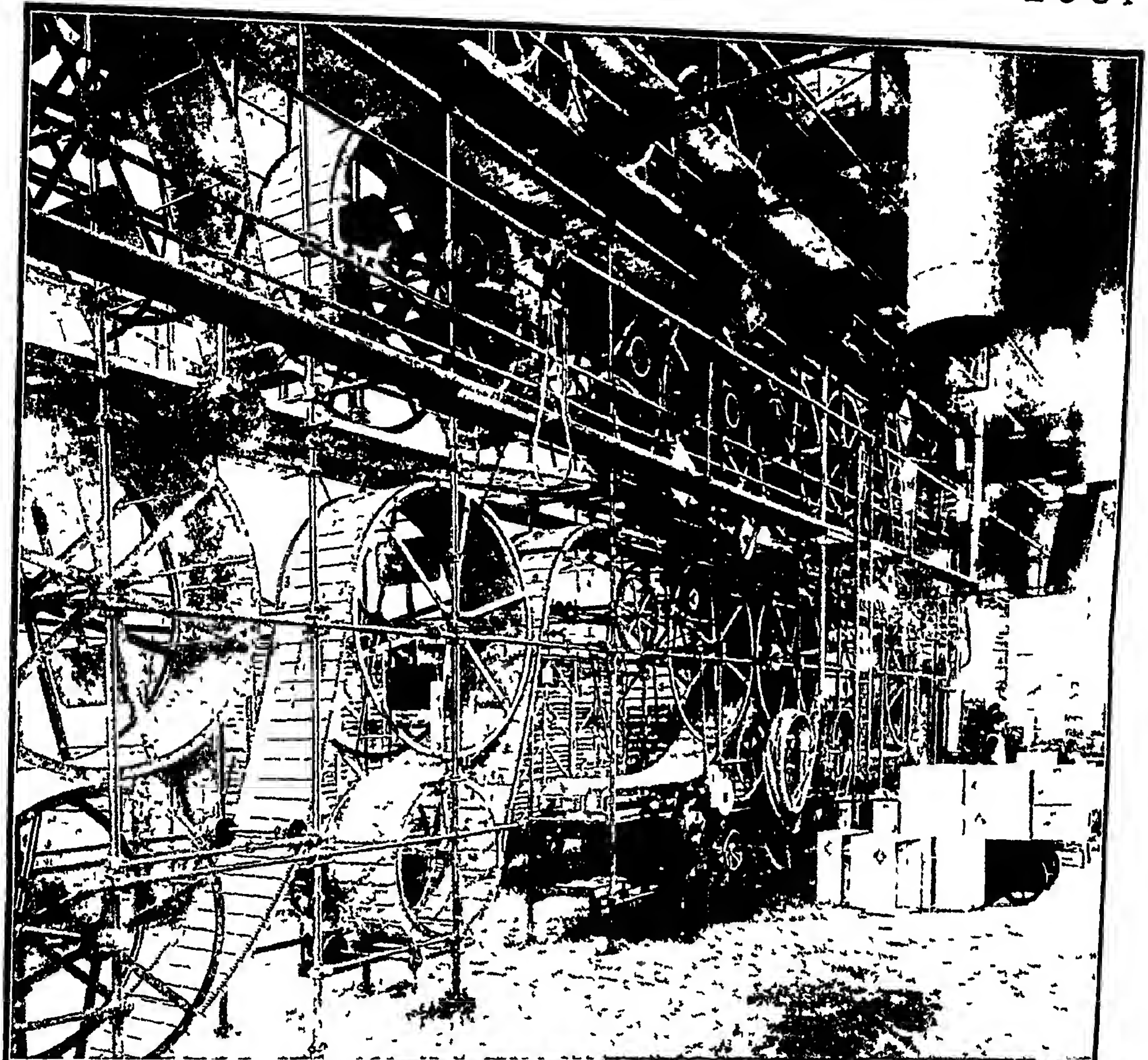
Cutting Splints

At the lower right is the part of the machine which actually puts the tips on the matches, still without the aid of a human hand to guide that delicate operation which makes the modern completely uniform match heads First comes the bulb dip which puts on the larger part of the match-head This bulb is inert to ordinary friction and protects the tip of the match, which is put on at a second dip This tip is the part which lights when you strike a match The lower sketch shows the old way of dipping matches after they had been rolled up into big "cart-wheels" Someone always had to stand by with a wet bush broom to put out chance sparks during the boiling and dipping processes

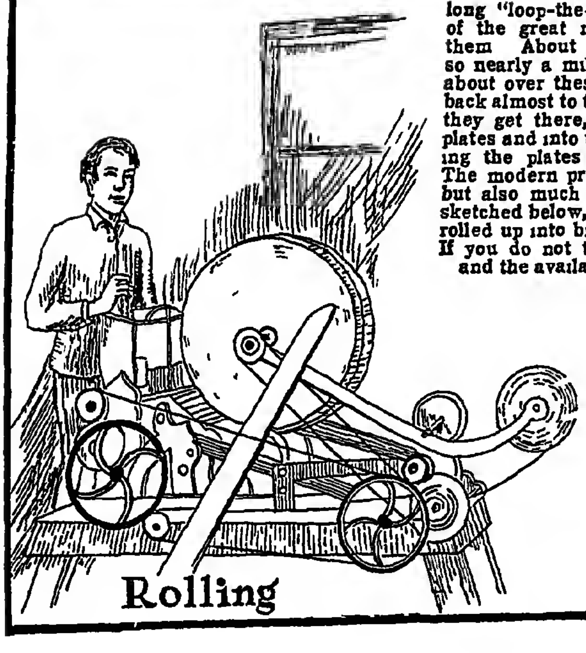
Dipping



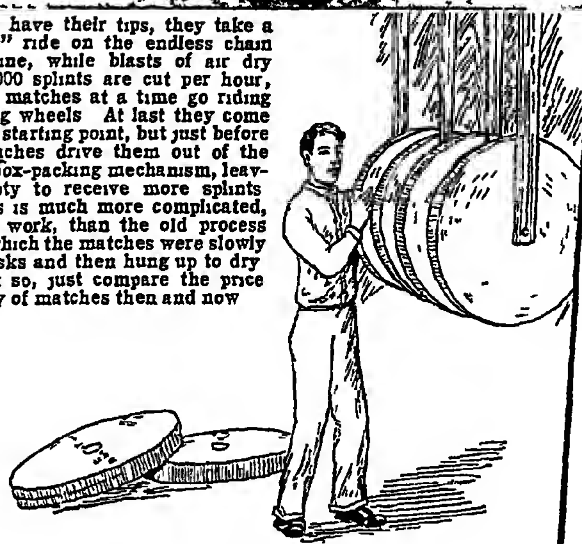
A MILLION MATCHES ON A LOOP-THE-LOOP



When the matches have their tips, they take a long "loop-the-loop" ride on the endless chain of the great machine, while blasts of air dry them. About 900,000 splints are cut per hour, so nearly a million matches at a time go riding about over these big wheels. At last they come back almost to their starting point, but just before they get there, punches drive them out of the plates and into the box-packing mechanism, leaving the plates empty to receive more splints. The modern process is much more complicated, but also much less work, than the old process sketched below, in which the matches were slowly rolled up into big disks and then hung up to dry. If you do not think so, just compare the price and the availability of matches then and now



Rolling



Drying

of the world's supply is made in the United States Sweden and Japan rank next in production, while England has some very large, modern match factories whose names are household words

Mathematics. It has often been stated by scientists that the lower animals are unable to count Cats, for instance, are unable to count the number of their kittens, or birds the number of eggs in their nests One of the most important facts about the human world is that objects in it can be counted and their dimensions and weights measured Far back in the dim ages when men first started to count, even on their fingers, the first of the sciences, mathematics, began to reach formal development

Mathematics may be defined as the science of number and quantity Elementary mathematics includes arithmetic, algebra, geometry, and trigonometry—all of which are described under their own headings Analytic and differential geometry, the theory of probabilities, differential and integral calculus, analysis of complex quantities, etc, constitute higher mathematics Then we have what is called applied mathematics, i e, mathematics used in such sciences as mechanics, electricity, optics, and astronomy

It was the Greeks who first lifted mathematics into the field of abstract thinking Because number and quantity seemed so tremendously significant, many of the ancients believed that number was the stuff from which the world was made, or at least a key to its meaning This seems almost a foreshadowing of what modern physical science has discovered—that every invariable numerical relation between physical substances is a clue to facts of the most important meaning

Thus when Galileo discovered that the velocity of falling bodies increases in a definite ratio with every stage of their fall, he had made an important step in the discovery of the law of gravitation Then, too, when Dalton found that chemical combinations only took place in definite ratios, there was born the atomic theory of matter, and with it the wonders of modern chemistry

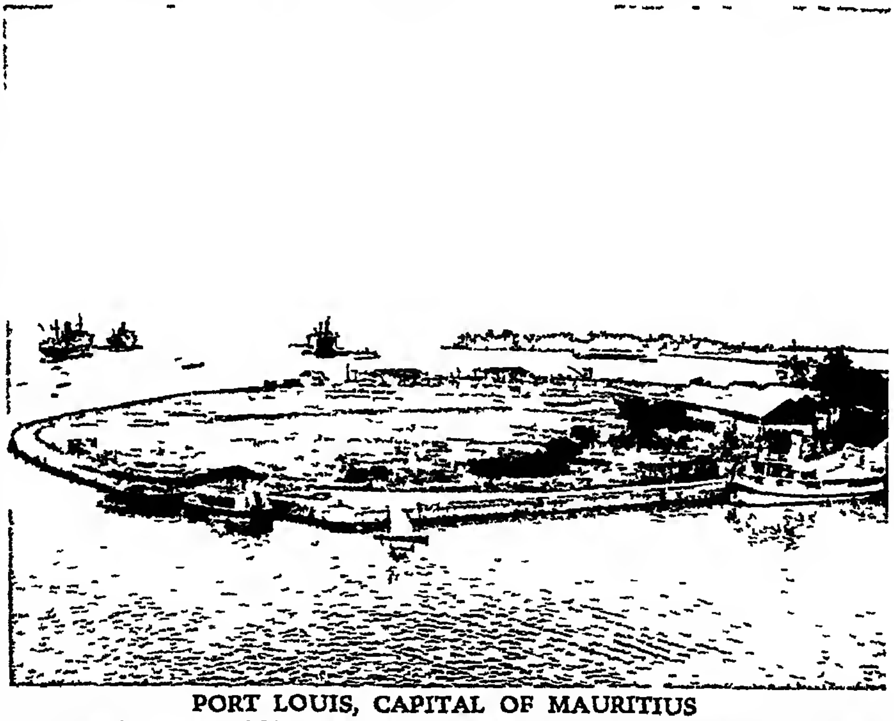
Mathematics has a very real and definite importance in life It is the one exact science from which spring all other mechanical and physical sciences Without it such callings as engineering could not exist, and a mathematical training is essential for all those who would adopt such professions

(*See* Addition, Algebra, Arithmetic, Decimals Division, Factors, Fractions, Geometry, Logarithms, Mensuration, Multiplication, Subtraction, Trigonometry, etc)

Mauritius. A little oval emerald fringed with coral and set in the sea—such is the tropical British island colony of Mauritius, in the Indian Ocean about 530 miles east of Madagascar Its picturesque beauty, with mountains more than 2,700 feet high, is well known from the description given in Bernardin de Saint-Pierre's classic novel, " Paul and Virginia "

Sugar is the chief export, and to it the island owes its prosperity Tropical fruits, coffee, cocoa, corn rice, spices, vanilla beans, hemp, and yams are also grown, for agriculture engages the majority of the inhabitants It is one of the most densely populated regions in the world Many Hindu coolies have been imported to work in the sugar-fields, in addition there are Chinese, Malays, negroes, and 4,000 whites

Mauritius was discovered about 1505 by the Portuguese, who soon abandoned it It was occupied in 1598 by the Dutch, who gave it its



PORT LOUIS, CAPITAL OF MAURITIUS

All the sea-borne trade of Mauritius passes through the capital, which possesses a fine natural harbour—an inlet a mile long which can accommodate ships of the deepest draught This photograph shows ships in the port unloading cargo in the stream and the new deep-water quay

Photo Roger Halbwachs courtesy of The Crown Colonist

present name after their Count Maurice of Nassau. The French were its next masters after the Dutch abandoned it in 1710, and they called it "Isle of France." The English conquered it in 1810.

Mauritius was once the home of the dodo, and of a large land tortoise and a crested parrot. It is also famous with philatelists as the original source of some of the world's rarest stamps, notably the "Post Office" 1d of 1847. Terrific hurricanes often sweep over the island, and these are generally followed by tidal waves, called by the inhabitants "les raz de la marée," which often create havoc among fishing craft. The capital is Port Louis (55,000), which is also the chief port and coaling station. It is a hive of activity and possesses a modern dockyard with every facility for ship-repairing. Area of Mauritius, about 720 sq. miles; population, about 393,000.

'POST OFFICE'
Here is the "Post Office" Mauritius stamp, one of the greatest prizes of the collector and worth thousands of pounds.
Courtesy of F H Vallancey

Mayflower. In the last three centuries thousands of ships have made their way to America, bearing from the Old World many of the men and women who have populated America, and whose genius and industry have developed her enormous natural resources, made her laws, and welded her into a great nation. Compared to most of these vessels, the Mayflower, a little sailing vessel of 180 tons, was but a cockle-shell. Yet no other ship's arrival was fraught with such significance as that of this little vessel, which carried the Pilgrim Fathers to America in the year 1620.

Why the 'Pilgrim Fathers' Emigrated

To understand who these Pilgrims were and why they went to America, we must go back to Elizabethan England round about the year 1600. Then it was that a group of earnest men and women began to gather together in secret for religious devotion at the home of William Brewster, which was the old manor-house of the little village of Scrooby in Nottinghamshire. They objected to the half-way religious settlement of Elizabeth, and were called Separatists because they wished to have a separate Church instead of conforming to an established Church of England. (See Puritans.) In thus following the dictates of their conscience, they defied the laws of the realm, and for this they suffered heavy penalties.

Because of these persecutions they were driven at last to leave England. There was one country where they knew they would be allowed to practise their own form of worship—that was Holland; and to Holland they went, after some difficulties, in 1608. From Amsterdam, where they landed, they went to Leiden, and there established a church under the leadership of their beloved minister, John Robinson.

But though they found freedom in Holland, it was not really home to them. Life there was very hard. Most of them had been farmers, and they were now forced, in this industrial and commercial community, to follow occupations to which they were unaccustomed, and by which they could earn only a bare subsistence. Worse still, their children were in danger of falling away from their faith, and were growing up partly Dutch instead of wholly English, a natural result of environment which they might have foreseen. So, after long discussions, it was decided to go out into the wilds of the New World, where they might preserve their native language and customs, and have freedom to worship as seemed right to them.

The Story of the Great Voyage

In 1620, after twelve years in Holland, they set sail in a little ship called the Speedwell. At Southampton they found another ship awaiting them, the Mayflower, having on board a number of Separatists from London, who wished to join the expedition. But the vessels had proceeded only a short distance when the Speedwell began to leak. Twice they were forced to turn back, and finally, abandoning the Speedwell, they sailed from Plymouth harbour on September 6, 1620, on the Mayflower.

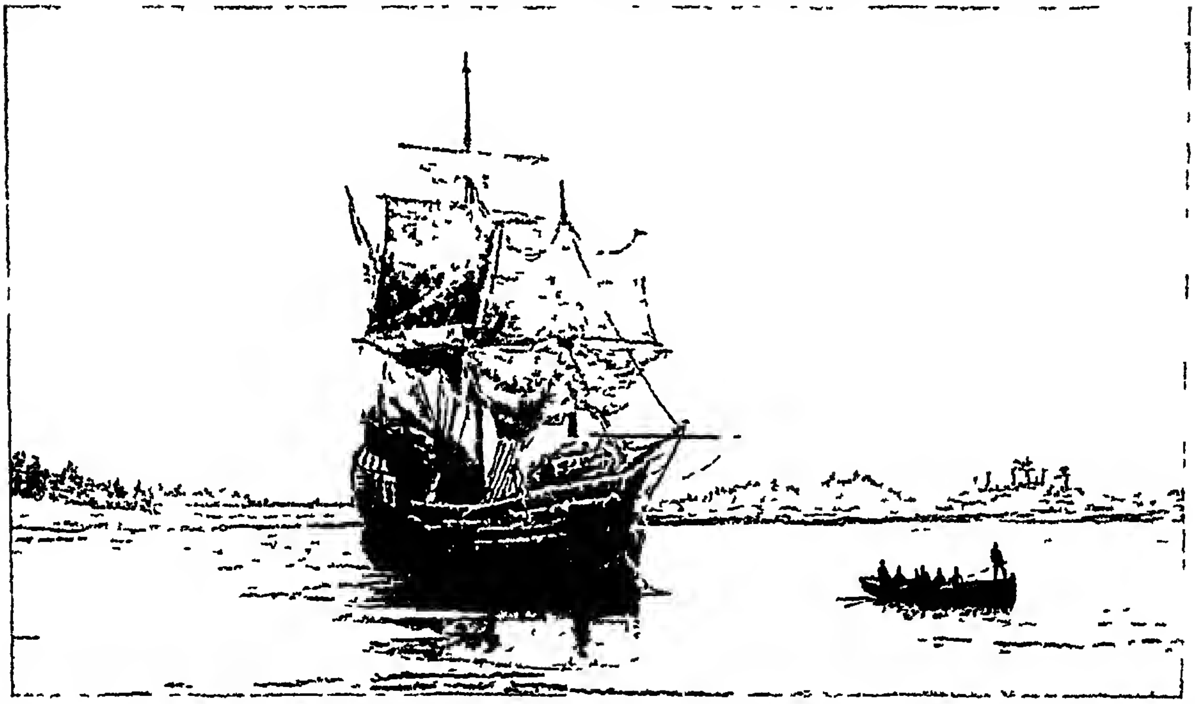
It is hard to realize today the hardships and perils of that voyage. The delays had brought them to the time of the equinoctial storms. For two months and five days the weary voyage continued. Living in the stifling air of their close quarters, upon the tossing ocean, many of the Pilgrims were sea-sick.

Landing of the Adventurers

At last they reached the bleak and desolate shores of Cape Cod, and the evening of November 19 found them safely anchored in the sheltered harbour just within the tip of the cape. But their troubles were far from being over.

"Being thus passed the vast ocean, and a sea of troubles," writes William Bradford, one of the leaders of the Pilgrims, in the quaint language of that time, "they had now no friends to wellcome them, nor inns to entertaine or refresh their weather-beaten bodys, no houses or much less townes to repaire too, to seeke for succoure. And for the season it was winter, and they that know the winters of that countrie know them to be sharp & violent, & subjecte to cruell & fierce stormes, deangerous to travill to known places, much more to serch an unknown coast. Beside, what could they see but a hidious and desolate wildernes, full of

WITH THE PILGRIM FATHERS IN THE MAYFLOWER



This picture by William F Halsall shows the Mayflower lying at anchor in the harbour at Plymouth, Massachusetts, while a party of the Pilgrim Fathers is rowing ashore to explore the land and prepare shelters for the settlement During the winter the colonists lived on shipboard, until they had built cabins sufficient to house all the company

The signing of the famous "Mayflower Compact,' one of the most memorable events in the history of America took place in the tiny cabin of the Mayflower, the day before the ship came into Provincetown Harbour Here one of the Pilgrim Fathers is putting his name to the historic document by which the colonists bound themselves to stand together and obey such laws as they might make for their general welfare as a self-governing community

wild beasts and wild men ? and what multitudes there might be of them they knew not "

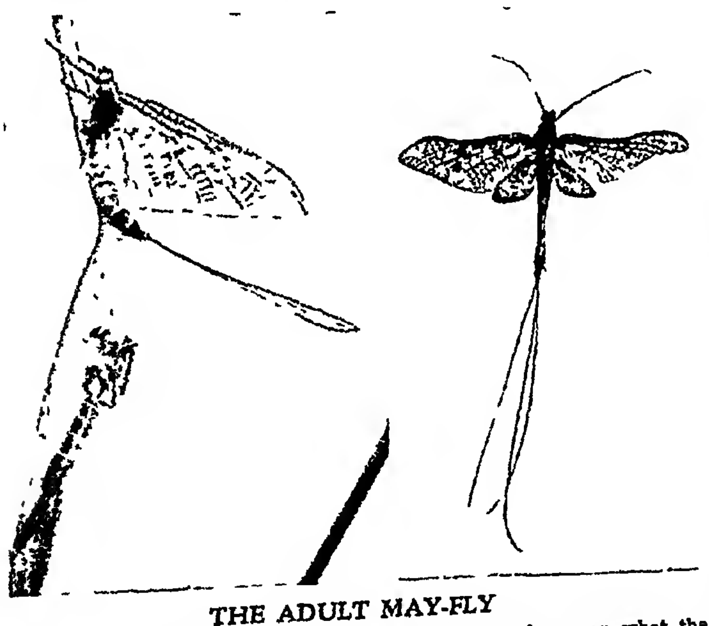
Their grant from the London Company was to settle in some place in "Virginia," but they had come to land north of that province They wished to sail south to the river Hudson, but the master of the ship refused and declared they must seek out a place of settlement where they were In a little boat they explored the wintry waters of the bay Such a site as they sought was found at Plymouth across the bay To that harbour the Mayflower was then moved

Before leaving the ship as " loyall subjects of our dread soveraigne Lord, King James," the heads of the Pilgrim band set their hands to the famous Mayflower compact In this they promised to " combine ourselves togeather into a civill body politick, for our better ordering and preservation and furtherance of the ends aforesaid, and by vertue hereof to enacte, constitute, and frame such just and equall lawes, ordinance, acts, constitutions, and offices, from time to time, as shall be thought most meete and convenient for the generall good of the Colonie, unto which we promise all due submission and obedience "

May-fly. Those delicate-winged insects—members of the order *Ephemeroptera*—with long threadlike tails, which in many places suddenly appear in clouds in late spring and early summer, filling up the globes of arc-lights, settling in helpless masses on windows and pavements, or covering the surfaces of ponds and lakes with their bodies, are called " may-flies," " shad-flies," or " day-flies " This last name comes from the extraordinarily short life of the adult insect, which was formerly believed to last but a day, and which, in fact, is rarely longer than a week The adult may-fly is incapable of taking any food, either solid or liquid, hence its brief life

But if the final stage of its life is short, the early stages are long Among the 300 or more species of may-flies are some that spend three years in the larval stage after hatching

The eggs are laid in large numbers in the water and sink to the bottom The larvae are strong and active creatures which spend their time swimming about, crawling on the bottom, or burrowing in the ooze in search of the smaller forms of animal and vegetable life on which they feed When full-grown, they rise to the surface, burst their skins, and fly away, as all the may-flies in one neighbourhood become adult about the same time, they are often seen in huge swarms Actually, there is a winged " subimago " stage before the insect is really *adult*, an unusual step not found in other insects Fish devour may-flies *greedily, and many of the artificial flies used by anglers are imitations of these insects*



THE ADULT MAY-FLY

These two pictures, both approximately natural size, show you what the adult may-fly looks like That on the left shows, too, the " sub-imago " skin from which the insect has just emerged The right-hand specimen is set out in a collection to show you its wings, antennae and " tails "

Photos J J Ward

Mayo, Co of Eire *Lying in the extreme* west of the province of Connaught, its long sea board washed by the Atlantic Ocean, is Mayo It is the third largest Irish county, covering some 2,160 sq miles, with a population of 161 000

Mayo is one of Ireland's most picturesque districts, its coast-line being indented by beautiful bays and guarded by numerous islands and islets, its interior a succession of mountains and valleys, lakes and rivers Here are Mulrea, Croaghpatrick (St Patrick's Mountain), 2,510 ft, the ruggedly picturesque Achill Island, Ireland's largest island, and Clare Island, situated off the coast, historic Killala Bay, where the French landed in 1798, and the river Moy, one of the most famous of all salmon rivers, to mention only a few of its glories Industrially and agriculturally, Mayo is not, however, so richly favoured Deep-sea and coastal fishing, and trout and salmon fishing on the rivers and loughs eke out agriculture This is generally confined to potatoes and oats and the rearing of cattle, pigs, sheep, and poultry Castlebar (population, 4,260), the county town is the centre of a splendid trout-fishing district

Mazzini, Giuseppe (Pron mat-sē'-nē) (1805-1872) Italy was "a mere geographical expression," made up as it was of many small states, when Mazzini the "Prophet of Italian Unity," lent his aid to the age-long task of rendering it a united nation

GIUSEPPE MAZZINI

Mazzini, an Italian revolutionary, was one of the three rulers appointed under the Republic of 1848 When united Italy became a monarchy, Mazzini refused to accept the new order and plotted for its overthrow until his death

In his youth the sight of the refugees from the unsuccessful rising in Piedmont led him to give up his promising career as a lawyer and journalist in Genoa, and to devote his life to working for unity and liberal republican ideas As one of the "Carbonari" (revolutionaries) he was imprisoned in 1830 When set free the next year, his life-plan was settled His first step was the formation of a revolutionary society called "Young Italy," whose motto was "God and the People" and whose banner bore on one side the inscription, "Unity and Independence," and on the other, "Liberty, Equality, and Humanity"

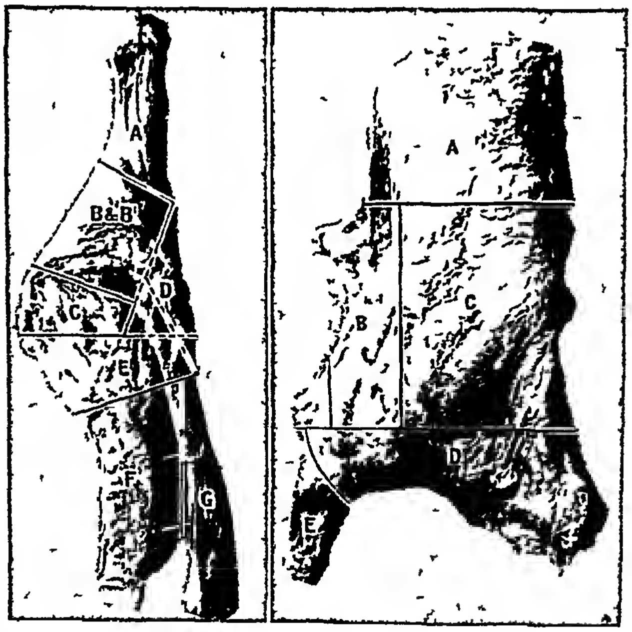
Mazzini's revolutionary activity made Italy exceedingly dangerous for him, and from 1832 he led the life of an exile He was the most untiring political agitator in Europe He was always writing, and his organizations soon extended through Italy For seven years he struggled hard against poverty in England, yet managed to help his poorer ignorant countrymen, the London organ-grinders, by teaching them in night classes

On the outbreak of the Lombard revolt (1848) Mazzini threw himself into the struggle When the republic was proclaimed at Rome, Mazzini was chosen to be one of three rulers with the power of dictators On April 26, 1849, however, the French soldiers arrived, and in June the republic fell, and with it the immediate plans for Italian unity

Ardent patriotism, heroic self-sacrifice, and unconquerable faith in the final triumph of his ideas made Mazzini a great leader of men Yet he could not work well with others, for he could never compromise This fault led to difficulties between him and the other two leaders of Italian unity—Garibaldi, its knight-errant, and Cavour, the statesman who conceived the plans which made union a reality

Mazzini was sentenced to death three times In 1866, after the kingdom of Italy was established, the sentence was rescinded, but he refused a pardon and continued to plot against the monarchy until his death

Meat. Although poultry, fish and other eatables may correctly come under this heading, we generally employ the word meat to describe the flesh of cattle, sheep, pigs and deer used for human food In other lands horses, reindeer, bears, and many other animals are also eaten To the meat derived from each of these sources we give distinctive names, e g veal from the calf, beef from the bullock or cow, mutton from sheep, pork and bacon from pigs, and venison from deer These again are subdivided into other categories, according to the particular part of the carcass from which the meat is cut, or the different processes it undergoes before being offered for sale in the shops



HOW A SIDE OF BEEF IS CUT UP

Here the quarters are marked off to show how they are cut for market Left, hind quarter A, leg , B, topside , B1, underside , C, aitchbone , D, thick flank , E, rump , F loin , G, flank , dotted lines show direction of cut on the other side Right, fore quarter A, fore-rib , B, brisket C, middle piece , D, clod and sticking , E, shin

For example, the carcass of the bullock is first cut by the butcher into fore and hind quarters, after

which each quarter is cut into a certain number of joints, each having a specific name Thus, the two fore-quarters, as you will see from the illustrations in page 2685, are divided into "cuts" or joints called the "fore-rib," the "middle piece," the "brisket," the "clod and sticking," and the "shin," while the two hind-quarters are cut into the "flank," the "rump," the "loin," the "aitchbone," the "underside," the "topside," the "thick flank," and the "leg"

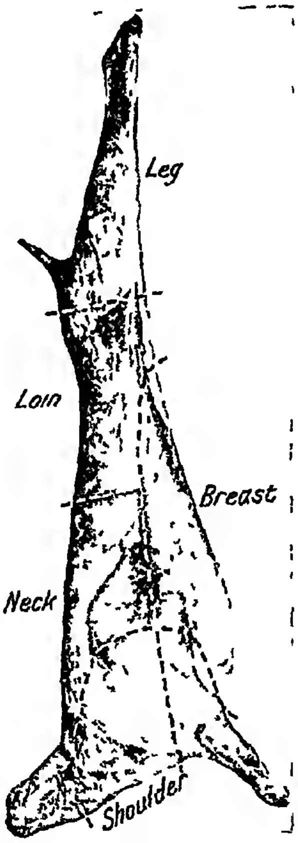
The carcass of the pig is split lengthwise, and, when used for bacon, the several cuts, beginning from the fore end, are named the "fore-hock," the "collar," the "thick streaky," the "back and ribs," the "thin streaky," the "long loin," the "flank," the "gammon hock," and the "corner hock" When used for pork, the joints, in the same order, are named the "hand," the "belly," the "loin," and the "leg"

The butcher cuts the sheep's carcass quite differently, as the accompanying picture shows, and the various cuts are known as the "leg," the "loin," the "breast," the "neck," and the "shoulder"

For veal, the calf's carcass is divided into the "leg," "loin," "breast," and "shoulder," while for venison the only cuts used are the "haunch," which includes the loin and the leg, the "shoulder," the "breast," and the "neck"

Although these are all trade terms, they are equally known to the housewife, who buys her joints under their various names

The meat trade of Great Britain is an immense industry catering for the needs of nearly 40,000,000 people having, approximately, an annual average consumption of 136 lb per head The great Smithfield Market, in London, the largest in the world, handles some 500,000 tons annually



MUTTON
Carcass of a sheep, showing the joints into which it is cut by the butcher

Meat Packing. Within quite recent years the business of meat packing has grown to proportions which have astonished the world and changed the lives and habits of people in many civilized countries It covers the whole process of buying, slaughtering, curing, preserving, manufacturing, and selling meats and their by-products The buyers are stationed at all of the leading livestock markets gathering up supplies from farm and factory, the salesmen and refrigerator cars carry their products to practically every meat and provision dealer The industry had its origin in the United States, Chicago being its main centre, but today, in many European and South American countries, there are numerous specialized meat-packing concerns, though none to equal in size or output the vast stock-yards of Chicago

'Packing-town' in Chicago

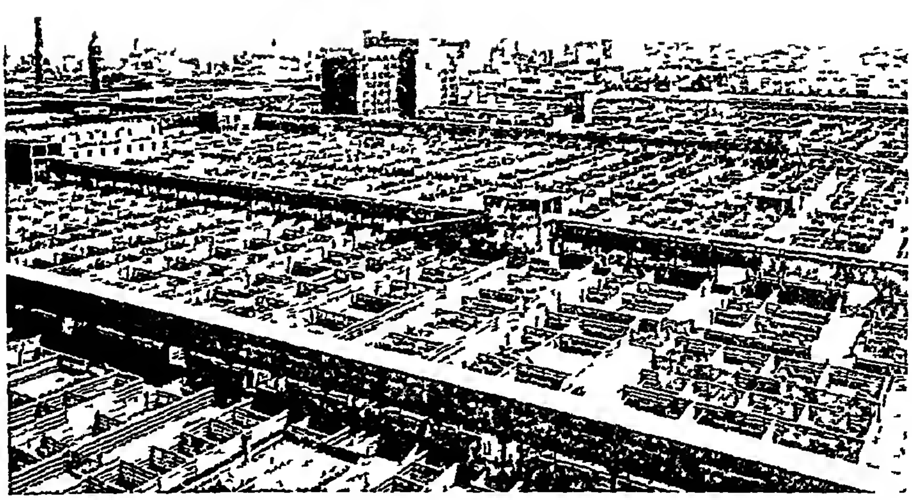
People who visit the Chicago stock-yards, commonly called "Packing-town," usually expect to find one set of buildings and many stock pens They see cattle, sheep, and pig pens in abundance, but they are astonished to find that the "yards" is a manufacturing city in itself, with many buildings and streets, banks and stores, telephone and telegraph exchanges Elevated railways run overhead and elevated pathways, pens, and buildings are everywhere Some idea of the size of this packing centre may be obtained from the fact that the Chicago yards comprise 500 acres, and include 300 miles of railway track, 25 miles of streets, and 13,000 pens They are able to handle daily 75,000 cattle, 100,000 sheep, or 200,000 pigs On a busy day you might be able to count 3,000 or more railway trucks bringing in animals

Many labour-saving devices are employed by the packing companies Animals are slaughtered and dressed and the meats taken to the refrigerating rooms in surprisingly short times Cattle are driven into a row of pens, killed, and hoisted by chains that move along an overhead track past a row of workmen Each workman performs one special task as a carcass passes him It takes only a few minutes to kill and dress a full-grown pig The greatest care is taken to keep the meat clean and sanitary, and to cut the carcasses so that nothing shall be wasted

Most noteworthy of the economies produced by modern packing methods, however, is the production of an astonishing array of by-products from parts of animals formerly thrown away as waste Hides and skins, of course, have always been made into leather, but now valuable products are made from the blood, bones, hoofs, horns, and entrails

The blood yields albumen, and serum for use in laboratories in the culture of bacteria It is also used in the manufacture of waterproof glue and fertilizer, and as blood meal for animal and poultry feeding Horns and hoofs are made into knife handles, combs, buttons, hairpins, umbrella handles, napkin rings, dice, and various knick-knacks Pig's bristles are used for brushes, and pig's hair for stuffing cushions and upholstery Hair from cattle and calves is

used in making rope, to stuff horse collars, and as a binder in plaster From sheep intestines is made catgut, used for the strings of rackets and musical instruments Several important preparations used in medicine are derived from the brains, stomachs, and glands of slaughtered animals These include insulin, pepsin, pancreatin, and thyroid extract The inedible fats are extensively used in making soap, lubricating oil, and illuminating oil (*See also* Refrigeration)



METROPOLIS OF AMERICA'S MEAT TRADE

Chicago is the greatest centre of the meat-packing industry in the world and its stock-yards are one of the sights of the city The photograph shows the rows and rows of pens in one of them Along the covered ways between the pens the animals pass to the slaughter-houses and canning factories A stock-yard is cleared in a day, and a fresh supply arrives in the night

Meath, Co of Eire Stretching northwards from co Dublin to the Carlingford Mountains, this Leinster county embraces some of the richest land in Ireland, and through its broad pastures run two noted trout rivers, the historic river Boyne and the Blackwater

For centuries " Royal Meath " was a separate province, ruled over by successive pagan and early Christian kings Here, in the valley of the Boyne, stands the Hill of Tara, with the ruins of the royal palace celebrated in the famous lines of Thomas Moore beginning, "The harp that once through Tara's halls " And here was fought on July 11, 1690, the battle of the Boyne, where James II was defeated by William III

Agriculture is the sole industry the proportion of pasturage to tillage being nearly four to one Great numbers of fine cattle and sheep are reared, and poultry farming is being developed on an ever-widening scale The area of Meath is 905 sq miles, and the population 64,000

The largest town is Navan (An Uaimh, population, 3,650), but Trim (population, 1,320) is the county town, and is notable for its antiquities Historic Kells, with its round tower, St Columba's house, and ancient crosses, linking it with the monks of Iona and their founder St Columba (521–597), is a place of pilgrimage for all interested in Ireland's past Here was written by the monks the famous Book of Kells, the most beautifully illuminated volume in the world It is now preserved in Trinity College Library, Dublin (*See* illustration in p 582)

Mecca, Arabia From the days of Mahomet to the World War of 1914–1918 no Christian is known to have openly entered this holy city of Islam and returned to tell the story Those who did so are the handful of adventurous men who went there in disguise or protected by a temporary profession of Mahomedanism But these few who succeeded in the attempt saw one of the most remarkable sights in the world, for an average of about 100,000 pilgrims from the whole Mahomedan world converge on Mecca in the 12th month of every Mahomedan year, on the sacred journey that every believer is enjoined to make at least once in his lifetime

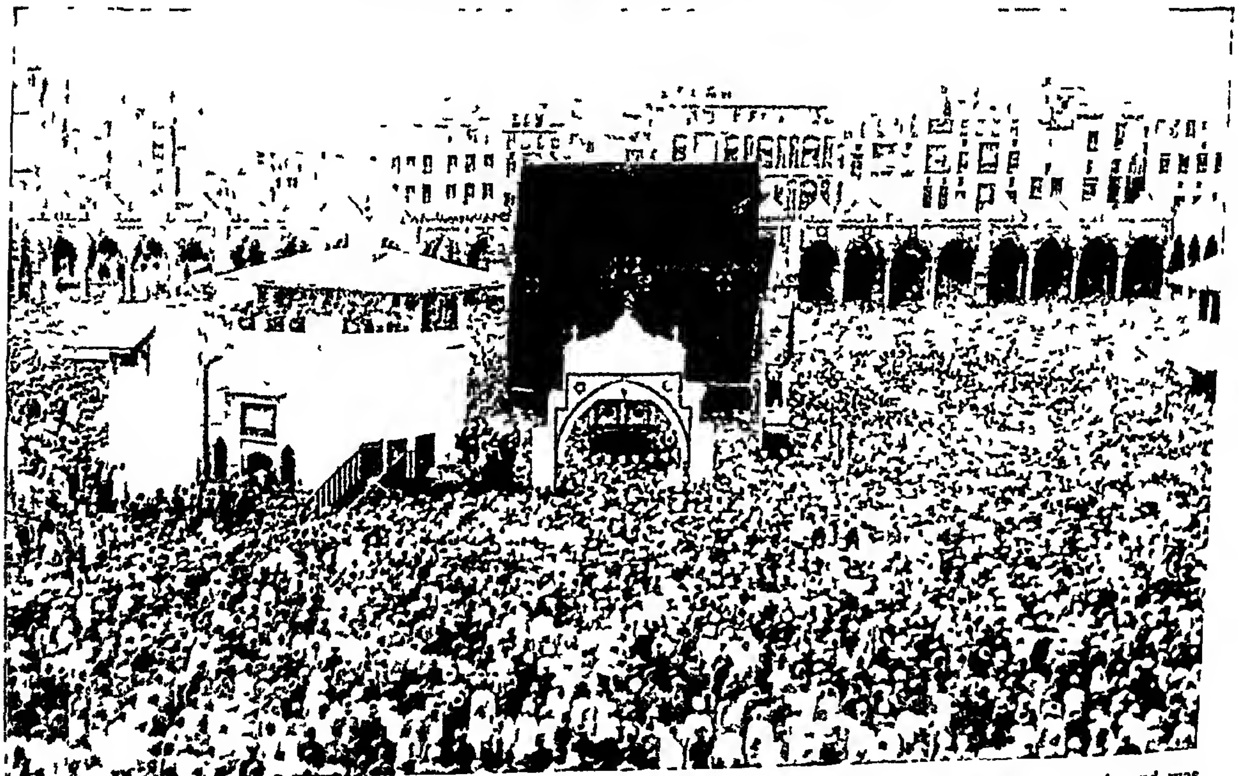
Caravans Across the Desert

Through the Suez Canal come the Egyptians, bearing their gift of a costly black brocade for the sacred Kaaba, the cube-shaped stone sanctuary in the court of the mosque Across the Indian Ocean come the faithful from Java, India, Iran, and Zanzibar, who disembark at the Red Sea port of Jidda and join the slow camel caravans across the 55 miles between the coast and Mecca Other caravans make the still longer progress down from Baghdad and Damascus, the wealthy pilgrims on camels, the poor on foot Of late years, however, many have used the Hejaz railway from Damascus to Medina, and since 1927 King Ibn Saud has provided motor-bus transport between Jidda and Mecca, and policed the route to protect pilgrims from Beduin robbers

The " forbidden city " lies hidden among barren hills in a valley where nothing grows The sun glares down upon it, there is never a breeze, and the rains which sweep down from the hills once or twice a year often amount to cloud-bursts that sweep away houses and damage the holy buildings Photographs show that it is a city of rather European-looking dark stone houses, three to five storeys high, built along

WHEN MAHOMEDAN PILGRIMS COME TO MECCA

In this view of Mecca during the pilgrim season notice the hundreds of tents set up to shelter the Mahomedan pilgrims, who have come to pay homage at the shrine of the Prophet The chief ceremony consists in kissing the "Black Stone" set in the wall of the Kaaba shrine, shown in the lower picture Then they circle the shrine seven times, three times running and four times walking Next they run up and down some of the sacred hills you see here, visit near by holy places, and throw stones "at the devil" in the neighbouring village of Mina Once the ceremonies are complete the pilgrims acquire the honourable title of "Hajji," together with the privilege of wearing a special green turban



Here are the pilgrims gathered about the Kaaba shrine in the courtyard of the Great Mosque This shrine, according to legend, was built by Abraham In one corner of it is set the "Black Stone," supposed to have been given by the angel Gabriel to Abraham The Kaaba here is covered with the carpet of black brocade brought from Cairo as a gift from the Prophet's Egyptian followers It is toward the Kaaba that all faithful Mahomedans in all parts of the world are supposed to turn at prayer time

streets that all slope to the Great Mosque—an immense open court surrounded by a colonnade—containing the windowless black-veiled Kaaba, the pulpit, and the sacred well of Zem-Zem

Long before Mecca appears round a bend in the mountains, the pilgrim shaves his head and puts on two white seamless garments in place of his travelling clothes He wears these until after he has kissed the sacred black stone that is built into the south-eastern corner of the Kaaba, and performed the other intricate ceremonies which occupy the next few days and reach their climax in a pilgrimage out to Mount Arafat, a half-day's journey away Here the pilgrim takes his stand at noon on the ninth day of the pilgrimage month and recites prayers and texts till sunset—the most important ceremony of the whole pilgrimage, and the one which alone entitles him to the coveted title of *Hajji* ("pilgrim") for the rest of his life At Mina, on the journey from Arafat back to Mecca, the pilgrims sacrifice an animal, throw stones at three pillars which are believed to represent Satan, then shave their heads again and put on ordinary clothing

During the sacred journey thousands die each year from hardship, or are killed by bandits, or are smitten by cholera and other epidemics that sweep through the multitudes as they crawl along the roads and stand closely packed on the sides of Arafat or in the Great Mosque

Mecca was a place of pilgrimage long before the rise of Mahomedanism When Mahomet was born, in A D 570, it was a commercial town of some importance, lying on the ancient incense trade route from southern Arabia It was also the centre for a cult then widespread in Arabia, and the Kaaba with its black stone fetish, supposed to be as old as the world, was surrounded by 360 idols, one for each day of the ancient Arabian year Mahomet kept the tradition and many of the ancient rites, while doing away with the idols Old Mahomedan legend attributes to Abraham the building of the first Kaaba, and it affirms that the black stone (probably of meteoric origin) came from the Garden of Eden with Adam and Eve

Mecca, as part of the province of Hejaz, was under nominal Turkish rule until the grand sherif of Mecca achieved independence during the World War In 1924 Ibn Saud, sultan of Nejd, with his Wahabi followers took Mecca, and two years later he was declared king The population of Mecca is about 88,000

LAWS *that all* MACHINES *must* OBEY

Every machine however simple or complicated, is governed by certain laws of force, resistance, and motion, and the study of these is called mechanics Thus this dry-sounding name really covers a most interesting subject

Mechanics. Far back in the dim ages, long before the days of recorded history, men had begun to increase the efficiency of their hands by the use of rude machines or tools embodying mechanical principles Having learned to grasp sticks, they found, accidentally no doubt, that these sticks could be used as *levers* to move stones too heavy for unaided human strength to lift It was easier to drag the killed game home up the sloping side of a hill than to pull it straight up over the face of a precipice, and some prehistoric inventor found that he could secure the advantages of an *inclined plane* by means of long smooth poles laid to slope from the mouth of his cave in the steep rock down to the level ground at its foot When men found that sharp-edged stones would split wood and bone, they had discovered the principle of the *wedge*, which they presently turned to account in making axes, knives, arrow heads, bodkins, and other sharp implements


Levers make work easier

A more deliberate ingenuity must have gone to the invention of the *wheel* and *axle*, the *pulley* and the *screw*, but these six simple machines (the lever, the inclined plane, the wedge, the wheel and axle, the pulley, and the screw) had all been invented before the dawn of recorded history We use them every day, both in the simple form and as elements in the steam-engine, crane, motor-car, etc

Archimedes first made known the principle of the lever—a rigid bar free to move about a fixed point called the fulcrum, used to raise a weight or to overcome resistance, in this the power has greater effect the farther it is from the fulcrum, the resistance remaining in the same place The motor-jack—by means of which a child can raise one end of a car weighing a ton or more—the seesaw, and the crowbar are familar examples, shears, tongs, and nut-crackers are double levers Almost all locks are constructed on the lever-action principle

The Egyptians are said to have used the inclined plane in building the Pyramids, and draymen now use it in loading heavy barrels into wagons The wedge is a double inclined

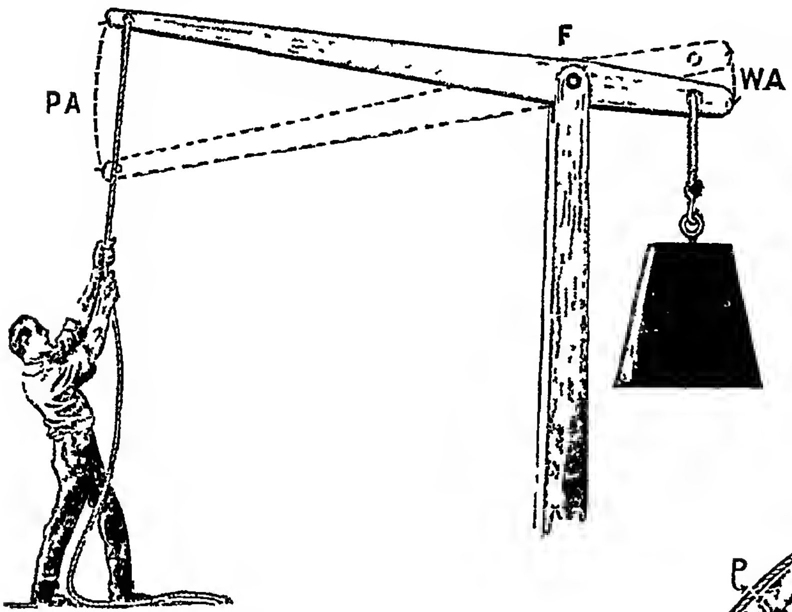
plane at the back of which power is applied, and we use it in knives, axes, chisels, etc

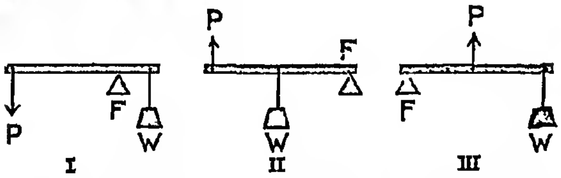
The wheel and axle, turning together about their centre, form mechanically merely a special form of lever, a small power applied to the rim of the wheel will balance a comparatively large weight suspended from or pulling on the axle Its applications are endless

The pulley is used to produce balance, as in balancing a window-sash against a weight, or to change the direction of force exerted, as the jack-screw, by which an immense weight may be raised by a comparatively small force

Such are the six fundamental "machines" of mechanics, that branch of physics which treats of the action of forces on bodies But one of the most wonderful things in science is that the same laws of forces that are true for simple machines are used to explain the most complicated occurrences of physics Thus, to understand the action of such a complicated mechanism as an electric dynamo or an electric motor, we use the same laws that we do in explaining the lever, wheel and axle, and other simple machines Every boy and girl should try to study how the machines about them act, that is, to understand the *mechanics* of the machine

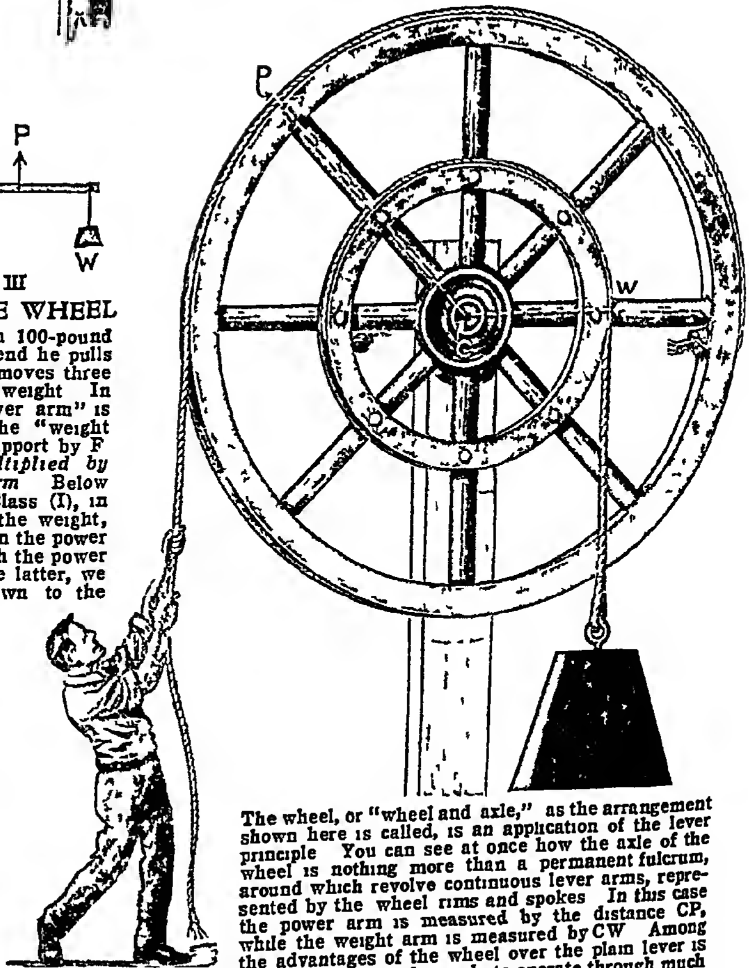
You have probably seen a bridge marked "maximum load 5 tons" How did the engineer know the safe load? As a matter of fact, the engineer made a drawing of the bridge before it was built, showing the size of each part, and calculating for the bridge when complete to carry its





THE LEVER AND ITS CHILD THE WHEEL

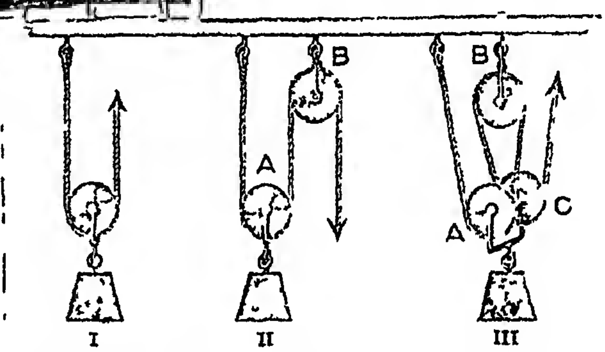
How can a man lift a 300-pound weight with a 100-pound pull? He can do it with a lever, provided the end he pulls is at least three times as long, and therefore moves three times as far, as the end which supports the weight In the picture the distance moved by the "power arm" is indicated by PA, the distance moved by the "weight arm" by WA, and the fulcrum or point of support by F According to the law of the lever, *power multiplied by power arm equals weight multiplied by weight arm* Below the picture are the three kinds of levers First Class (I), in which the fulcrum is between the power and the weight, Second Class (II), in which the weight is between the power and the fulcrum, and Third Class (III), in which the power is between the weight and the fulcrum In the latter, we must imagine the lever as being fastened down to the fulcrum In the Third Class levers, the power must be greater than the weight, for the weight moves through the greater distance



The wheel, or "wheel and axle," as the arrangement shown here is called, is an application of the lever principle You can see at once how the axle of the wheel is nothing more than a permanent fulcrum, around which revolve continuous lever arms, represented by the wheel rims and spokes In this case the power arm is measured by the distance CP, while the weight arm is measured by CW Among the advantages of the wheel over the plain lever is the fact that it can be made to operate through much greater distances, and the fact that power may be applied to the fulcrum (axle) as in the case of the driving wheels of engines and motors

when a bucket or a lift is raised by pulling down, but its most important use is to multiply the power applied, as in the combination of fixed and movable pulleys used in hoisting tackle, cranes, derricks, etc

The screw is an inclined plane twisted round a cylinder used to overcome great resistance or to exert great force in almost as many ways as the wheel and axle Besides the carpenter's screws and bolts, we have the screw-press and



PULLEYS AS LABOUR-SAVERS

In the larger picture the weight (P) is supported by the two ends of the rope (M and N) passing through a "moving" pulley (O) The man has only to pull against one-half the total weight, for the overhead beam and its rope (M) supports the other half However, to raise the weight he must pull in twice as much rope as he would if he lifted it directly, for he must shorten two ropes instead of one This simple type of pulley is also shown in the diagram (I) The "fixed pulley" (B) in the next set (II) merely changes the direction of pull without multiplying the power, because the downward pull is not acting directly upon the moving or weight pulley (A) In Figure III there are four supporting strands acting directly on the weight through the moving pulleys (A and C), so in such an arrangement a given pull will move a weight four times as great There is, of course, a corresponding loss in the space travelled by the weight The fixed pulley (B) simply turns the rope back to pass through the second moving pulley (C), and does not affect the working power The law of pulleys says that "the lifting power is the power applied multiplied by the number of strands acting directly upon the moving pulleys" In the block-and-tackle rigging all the fixed and all the moving pulley wheels are incorporated in two "blocks" The result is the same as in Figure III, where the wheels are shown separate for clearness

own weight and the biggest load that was to be allowed to pass across it

In the case of a bridge or of a building, the forces act so as to produce no motion, that is, they are balanced That part of mechanics which deals with balanced forces is called "statics"

A good example of balanced forces is seen in the crane used by builders and wharfingers to lift heavy loads The crane is a combination of the lever and pulley principles

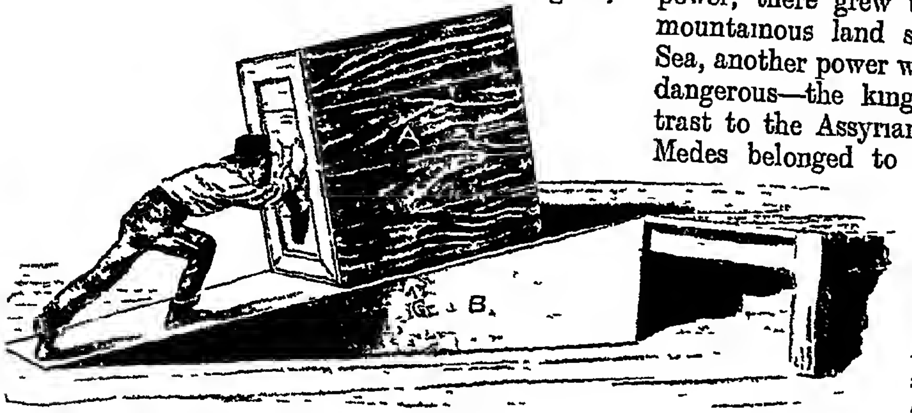
When a force acting on a body is not balanced, there is motion of the body In the steam engine, the unbalanced force of the steam against the piston produces the motion of the piston, and this motion is transmitted to the driving shafts, and thence by belts and pulleys or cog-wheels to some machine tool In the locomotive, the unbalanced force through the coupling acts on the train of carriages and moves them That part of the science of mechanics which treats of forces producing motion in bodies is called "dynamics" or "kinetics"

The simplest and most common case of an unbalanced force producing motion is that of an unsupported weight It falls to the ground with a velocity which increases uniformly, that is, with a constant increase or acceleration of speed Starting from rest, the body falls in one second 16 feet, in two seconds the distance fallen is 64 feet, in three seconds 144 feet, etc Its velocity thus increases 32 feet per second in each second This is expressed by the formula $S = ut + \frac{1}{2} ft^2$, where S = the distance travelled, u the initial velocity, t the time taken and f the acceleration Thus the distance a body dropped from an aeroplane will traverse in 10 seconds is easily found, for $u = 0$ (the body being initially at rest), $f = 32$, and $t = 10$ So, substituting, we get $S = 0 \times 10 + \frac{1}{2} \times 32 \times (10)^2 = 0 + 16 \times 100 = 1{,}600$ feet The force in the case of the falling body is the force of gravity or weight, that is, the attraction which the earth exerts on all bodies, the most universal and yet the most mysterious of all forces

The wonderful progress made in using the forces of Nature is due primarily to Galileo's studies From his famous experiments, particularly those at the leaning tower of Pisa (1588–1590), Galileo discovered the law of the motion of a body acted on by a constant force

Nearly a century later Sir Isaac Newton stated the completed facts connecting the motions of bodies and the forces It is said that Newton got his idea from watching an apple fall from a tree, thus showing that a common occurrence, when properly studied, leads to great results Newton's great book, "The Mathematical Principles of Natural Philosophy" was published in 1687

In modern mechanics, we study such subjects as the forces in rotating machinery, the pressure and speeds of flowing water and of whirling air,



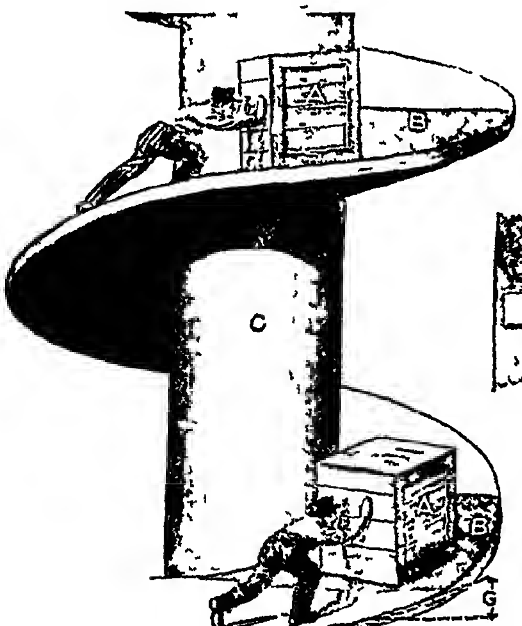
PRINCIPLE OF THE INCLINED PLANE

the flow and oscillation of electrons in the electric current, the vibrations of light, wireless, and X-ray waves, and all these varied motions depend upon the laws of dynamics derived from Newton's famous three fundamental laws of motion These are as follows

(1) Every body stays at rest, or, if in motion, continues moving uniformly in a straight line, unless acted on by an outside force That is, matter has *inertia*

(2) To set a body in motion, or to stop a moving body, *the force required is greater the greater* the mass of the body, or the quicker the body is started or stopped Also the change of motion is in the direction of the acting force

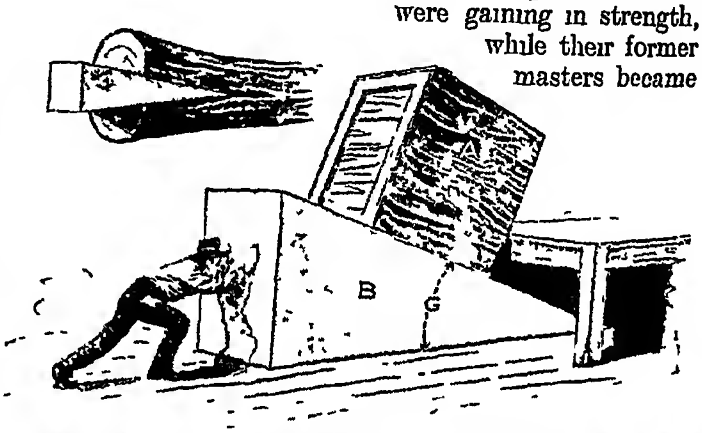
(3) To every action there is an equal and opposite reaction



Here we see the inclined plane in the most ingenious form of all—the screw You remember how we showed that the wheel was simply a continuous kind of lever revolving around an axle? Well, in the same way, the screw is simply a continuous kind of inclined plane, winding around a central supporting shaft The larger picture shows how our workman would look if he were following the thread of a giant screw In the smaller picture we see how this principle is applied in the vice and similar tools

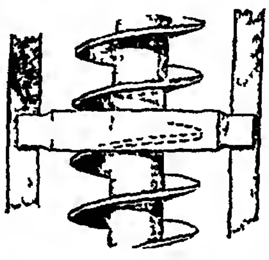
Medes. In the long-ago days when the mighty Assyrian Empire was at the height of its power, there grew up on its borders, in the mountainous land south-east of the Caspian Sea, another power which steadily became more dangerous—the kingdom of Media In contrast to the Assyrians, who were Semites, the Medes belonged to the great Indo-European family, from which we ourselves and practically all the peoples of Europe except the Jews are descended

Once subject to the Assyrians, these people, simple in their habits and strong in body, had won their independence and were gaining in strength, while their former masters became



Suppose a workman, who can lift 200 pounds and no more, has to raise a 400-pound box (A) to a platform Obviously, he cannot lift it directly, but if he laid a long sloping plank—that is, an "inclined plane" (B) up to the edge of the platform, he could do the job easily, provided, of course, he got rid of excessive friction by putting rollers under the box. The principle of the inclined plane is that the smaller the angle (G) of the inclined plane, the easier it is to move the weight, although the weight must, of course, travel over a correspondingly greater distance In the lower picture, the principle of the wedge is illustrated, which is simply our first inclined plane reversed, the sloping plane being driven under the object to be lifted

weakened through wealth and luxury At length the Medes in 606 B C swept down from their heights on Nineveh, the Assyrian capital, and, with their Babylonian allies, laid that splendid city in ruins



For a brief time the Medes were the greatest power in western Asia But among their vassals were the Persians, another Indo European people, who were, like the Medes, followers of the religion of Zoroaster, a form of sun-worship, and who had the same language and customs And now again the subject state became the ruler, for Cyrus the Great, king of Persia, about 558 B C seized the throne of the Median king Astyages In course of time the two peoples were merged into one as "Medes and Persians"

Medici. (Pron med'-i-chi) In the stirring days of the Renaissance many families rose to princely power over Italian cities by force of arms, intrigue, and assassination The Medici of Florence, on the other hand, rose chiefly by their

wealth derived from commerce and banking, and for a century concealed their absolute rule under the popular forms of a republic

Giovanni de' Medici (1360–1429) was the real founder of the wealth and power of the family His son Cosimo (1389–1464) did vast banking and commercial business by means of his branch houses in Rome, Venice, Geneva, Bruges, London, and elsewhere, at the same time he ruled Florence through his skill in securing the election of his own friends Cosimo was a generous patron of art and literature

With Cosimo's grandson, Lorenzo the Magnificent (1448–1492), the glory of the Medici reached its height He escaped the fate of his younger brother Giuliano, who was stabbed to death in 1478 as the result of a plot of their Florentine enemies Lorenzo continued his grandfather's policy and even excelled him in the munificence of his patronage of men of letters and artists, including the youthful Michelangelo

LORENZO DE' MEDICI

Lorenzo de' Medici, known as the Magnificent, in the 15th century raised Florence to the highest pinnacle of its greatness

Uffizi Gallery Florence photo Alinari

Lorenzo's influence at Rome enabled him to secure the election as cardinal, at the early age of fourteen, of his second son Giovanni Later this son became Pope as Leo X (1475–1521), and gained fame for his patronage of fine arts

The later Medici—from 1530—bore the title of Duke of Florence In 1569 Cosimo the Great received from the hands of Pope Pius V the title of Grand Duke of Tuscany The Medici continued to rule until 1737

Catherine de' Medici (1519–1589), great-grand-daughter of Lorenzo the Magnificent, became the wife of one French king (Henry II) and the mother of three others—Francis II, Charles IX, and Henry III She was ambitious to keep undiminished for her sons the power of the French monarchy France was torn by religious wars, and in the minority of her sons Catherine intrigued now with the Catholic party, now with the Huguenots, and was chiefly responsible for the terrible St Bartholomew's massacre (*See* illus pp 2132–3)

MAKING & KEEPING *the* BODY HEALTHY

Medicine, in one form or another, is one of the oldest sciences, for the most primitive men learned something of the curative and apparently magical effects of herbs which they saw the animals eat

Medicine AND SURGERY When a little girl was asked what medicine is, she said, "It is some nasty stuff that you have to take when you are sick" Now that is one meaning of the word "medicine," but it is a secondary and unimportant meaning Medicine really means "healing" Drugs nowadays play only a small part in the treatment of disease The sooner the little girl and all other people find that out, the better it will be for them Medicine, in this wider sense, is the science and art of preventing, curing, and alleviating disease

If our knowledge of medicine were perfect, perhaps we could prevent all diseases Even with the present knowledge thousands of lives are saved annually through the control of typhus fever, small-pox, lockjaw, rabies (caused by mad-dog bite), diphtheria, and other diseases that used to kill many people

Curing disease is more difficult than preventing it The body really cures or attempts to cure itself All the doctor can do is to help the body to cure the disease But this is very important, because often the body cannot do it by its own unaided efforts

People often confuse the symptoms with the disease itself For example, if you have an aching tooth, and you put in something that stops the pain, you do not cure the disease at all The tooth must be properly treated by a dentist Probably the best he can do is to stop the disease for a time by digging out the decay and filling the cavity with some protective material This illustrates the third part of our definition of medicine, namely, "alleviation"

Diagnosis—the First Step

Now if you have learned the real definition of medicine and understand the three parts of it, you can see plainly that the first thing necessary is to identify the disease producing the symptoms This is called "diagnosis" To do this the doctor must know the cause and nature of all diseases, and be familiar with all their symptoms Then, from his knowledge of the patient's history and his experience of similar cases, he is able to diagnose the cause,

A VISIT TO THE DOCTOR IN THE MIDDLE AGES

This illustration of a doctor's house is from a fifteenth-century manuscript The doctor is wearing a robe with fur lappets, and, as is not uncommon in drawings of this time, the artist, wishing to show two separate actions, has drawn the same man twice in one picture—attending to the injured arm of a young man, and preparing a potion for another patient The right of the picture shows two more men arriving to have their injuries attended to

British Museum Royal MS

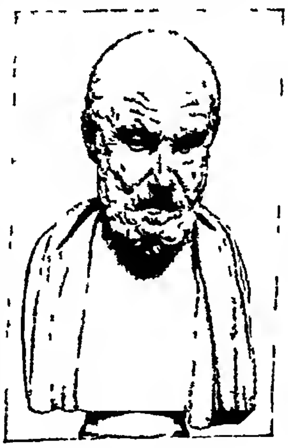
and to prescribe those medicines and methods of management which will either cure or greatly alleviate the disease

Each one of these three things has been very hard to find out Mankind has only slowly learned through ages of study something of the nature of disease

First, it had to be discovered how the body is constructed (Anatomy) and how it works (Physiology) The body works as a chemical machine, so physiology has to depend on chemistry Then men had to learn what disease does to the body—how it changes the body This science is called Pathology

It is only within the last seventy-five years that we have learnt much about the cause of disease The germ diseases are the best-known These are caused by the growth in the body of very minute plants or animals, which are called bacteria (*q v*) Each kind of malignant germ causes or is identified with a particular disease Pasteur, the great French chemist, was the first to prove that certain diseases are due to germs Now we know that diphtheria, typhoid fever, tuberculosis, and numerous others are germ diseases (*See* Germ Theory) There are some diseases—for example, cancer—of which the cause is not yet known

The diagnosis of the particular disease a person has is often very difficult The doctor must have a thorough knowledge of anatomy, chemistry, physiology, and pathology He must apply various chemical tests, use the microscope, X-ray examinations, etc Most important of all, he must obtain a complete medical history of his patient, showing his previous illnesses, as well as information regarding his habits, employment and general economic position



HIPPOCRATES

The "father of medicine," as Hippocrates was called, lived in Greece about 400 B C

British Museum photo Mansell

When the disease has been recognized, then only can it be treated with some assurance of really helping the body to cure itself But if the disease is one whose cause is unknown, the doctor is greatly handicapped When the cause is known, however, the chances are better In some cases scientists have found chemicals (drugs) which will pick out and kill germs in the body without killing body cells

Surgery is another method of treating disease Sometimes the diseased part may be cut away entirely Clogged tubes may be

opened and cleaned out Sometimes displaced parts are rearranged in their proper places Surgery has improved wonderfully in the past fifty years, owing to the discovery of anaesthetics and to the introduction of antiseptics by the famous surgeon Lord Lister

Some diseases are due to wrong foods, and the diet needs correction The discovery of vitamins has been very important in this connexion In some diseases, like influenza, complete rest in bed is an essential part of the treatment Rest is simply giving the body a full chance to cure itself In other diseases, however, not rest but exercise is needed

Treating the Ills of the Mind

The mind has an important influence over the body Hence mental therapy is often valuable There are, in fact, countless cases of physical disorders induced by worry, nervous strain, or mental shock, as well as purely imaginary ailments, all of which call for mental treatment But the science of medicine makes a sharp distinction between such nervous troubles and the diseases which demand psychical treatment

Massage and manipulation of the joints are frequently valuable in establishing a better circulation of blood and lymph, and, therefore, in helping the body to cure itself But in some conditions they do harm Baths, X-ray, and radium are other methods of treatment for particular conditions

We see, therefore, that the little girl's unpleasant tasting "medicine" is only one of numerous ways of treating disease All of these are parts of medicine in the true sense of the word We see that there is only one science of medicine All well-trained physicians use the same treatment whenever a definite cure has been found For example, all kinds of doctors use antitoxin for diphtheria, all kinds of doctors set a leg when it is broken, all kinds of doctors use cylindrical lenses for astigmatism It is only in diseases where the cause and cure are not entirely understood that doctors differ to any great extent

That is the reason that so many cults or schools of medicine have flourished Among savage tribes the chief is often a medicine-man Various rites, incantations, dances, and drumming are used to get rid of the demons that are supposed to cause disease The sick people often get well, so they believe in the treatment In ancient Egypt, the priests of the Egyptian gods were the physicians In Greece Aesculapius was the god of medicine When people got well, they believed in these gods And so it has always been, no matter how absurd the treatment prescribed

Hippocrates (b about 460 B C) is called the father of medicine He was the first who carefully described symptoms and diseases This was a great advance, but the causes of disease were still absolutely unknown Hence various sects arose, according to the theory of disease or treatment which was adopted There were the "dogmatists," and "empiricals," and "methodists," and "humouralists," and "solidists," and various others in ancient and medieval times The "allopaths" believed that remedies should produce conditions unlike the symptoms The "homeopaths" believed that remedies should produce conditions similar to the symptoms More recently the "osteopaths" asserted that many diseases were caused by the wrong adjustment of bones, and the "chiropractic" theory holds

ANAESTHETICS COME TO THE AID OF SURGERY

One day in 1847 James Simpson (1811–1870) a Scottish doctor, made an experiment which resulted in surgery becoming almost painless Simpson and his assistant inhaled chloroform, became unconscious and revived without ill effects The experiment was made in the presence of Simpson's wife, her sister, and her niece, who watched it with acute anxiety

that disease is caused by displacement of the vertebrae and the resulting abnormal pressure on the nerves

If anyone should read this article and think he would like to be a doctor, let him decide first whether he would like the doctor's life and whether he desires to serve mankind in that capacity Unless he really feels that medicine is for him a true vocation rather than a means to earn a livelihood, he should dismiss the idea

After deciding on a medical career, the first step is to pass the medical preliminary examination of either a university or one of the recognized medical licensing bodies This consists in one part of English, Latin mathematics, and, usually, an optional foreign language, and, in a second part, of chemistry, physics, and biology, Having passed the preliminary examination, the embryo medical student must register as such with the General Medical Council (44, Hallam St, London, W 1) before proceeding with his studies A student intending to take a university degree, such as M D (Doctor of Medicine) or M B (Bachelor of Medicine), will train for two years in the general scientific aspects, and will afterwards enter a medical school recognized by his chosen university The majority of English students enter one of the schools attached to one or other of the 20 big London hospitals

"Daily Mirror"

BEING TREATED BY 'DR SUN'

Medical science now fully realizes the value of sunlight in healing and strengthening the body This photograph shows crippled children basking in the sun at the Stanmore branch of the Royal Orthopaedic Hospital, where they are beyond the area of London fogs

Having completed his studies and qualified for a particular diploma—M B, M D, L R C P, L R C S, or M R C S, according to the licensing body concerned—the newly-fledged doctor becomes a registered medical practitioner under the General Medical Council, and is now fully bound by its ordinances and regulations

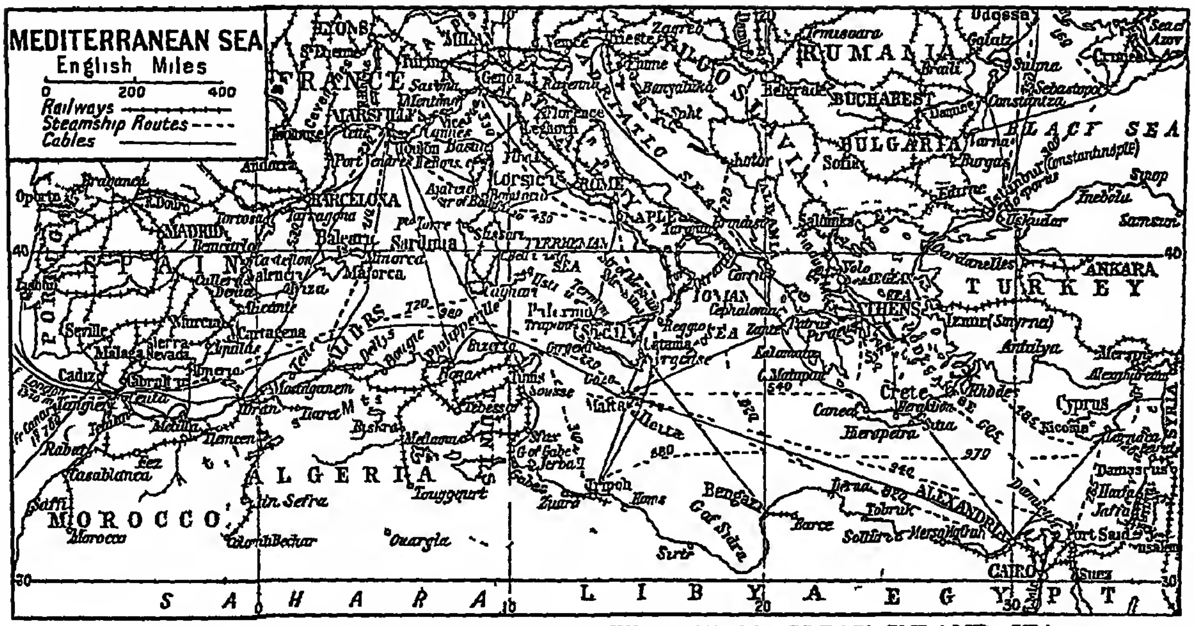
Many careers within the profession are now open to him He may go into general practice at once, or he may take a post as house surgeon or physician in a hospital or institution as a first step to specializing as a general surgeon, a throat, nose, and ear consultant, or as an expert in gynaecology, diseases of children, or in public health practice Indeed, it is true to say that no other profession offers so many fields for specialization as does medicine

The Services—Army, Navy, and Air Force—offer splendid opportunities to young doctors, so do the Indian and Dominion and Colonial Medical Services The rapidly increasing state medical services for schools, infant and maternal welfare centres, sanatoria and mental institutions, to name only a few, are constantly demanding doctors Great industrial concerns, insurance companies and shipping lines present further openings for medical men

Mediterranean Sea. Thousands of years ago the Mediterranean was the centre of the world and its first school of navigation Today, with Asia and Africa assuming new importance along its shores and involving Europe in new rivalries, the Mediterranean becomes again a centre of the world's interest

The Mediterranean is 2,400 miles from end to end, 1,200 miles at its broadest, from Venice in Italy to the Gulf of Sidra in Tunisia, and 300 on an average, and, at the highest estimate, 1,053,000 square miles in area It is almost entirely enclosed by Europe on the north and north-west, Africa on the south, and Asia on the east, with a narrow opening into the Atlantic at the Straits of Gibraltar, and another narrow opening into the Black Sea at the Dardanelles For convenience of description it is divided into (1) the Western Mediterranean, or that part west of Sicily and Malta, (2) the South-eastern Mediterranean, east of Malta, (3) the Adriatic sea, the large arm between Italy and Yugoslavia, and (4) the Aegean Sea, between Greece and Asia Minor

There are really only two basins, however, divided by the Italian peninsula, which nearly touches Cape Bon in Africa, with Sicily in



INDENTED COAST OF THE MEDITERRANEAN, GREAT INLAND SEA

between and a high ledge covered only a few yards deep by the sea This barrier is a centre of volcanic activity, marked by Vesuvius in Italy, Etna in Sicily, and Stromboli thundering down great balls of lava on the Lipari Islands This subterranean seething has sometimes cast up islands almost overnight The greatest depth in the eastern basin is 14,400 feet, south-west of the Morea, in the western basin, 12,200 feet, east of Sardinia At Gibraltar the depth is 3,000 feet, yet just outside in the Atlantic it is only 1,200 The chief islands of the western division are Sicily, Sardinia, Corsica, and the Balearic group, and in the eastern, Cyprus, Rhodes, Crete, the Ionian Isles, and Malta

Were it not for the stream flowing in from the Atlantic, the Mediterranean would no doubt dry up in a short time to a salt desert like the former seas of Asia, for the sea loses three times as much by evaporation as it gains from the few great rivers that flow into it—the Ebro, Rhône, and Po from Europe, and the Nile from Africa From the Black Sea—replenished by several great rivers—there is also a strong current The Suez Canal, opened in 1869, connects it through the Red Sea with the Indian Ocean, and restores the Mediterranean to its old place as a link in the route to India and the Far East

The Mediterranean contains 400 species of fish, about twice as many as any other sea Sponge, tunny, and sardine fisheries are important, and divers bring up a wealth of red coral on the coasts of Provence, the Balearic Islands, Sicily, Tunisia, and Libya

Meerschaum. (Pron mēr′-sham) The name of this mineral is borrowed from the German and means "sea-foam" It is a white or cream coloured clay-like substance, which, when dry, will float on water When first dug from the earth it is soft, like soap, and it makes a lather in water, and takes out grease, chemically it consists of hydrated magnesium silicate In Europe it is found in Moravia, Spain, and the Crimea, and in Asia Minor there are large beds of it just below the soil It is also found in South Carolina, U S A

The best quality comes from Asia Minor It is mined in blocks about a foot each way, and is carefully packed in cotton to avoid damage in transit Meerschaum pipes, being porous, absorb colour from the burning tobacco and take a high polish Vienna and Paris are the manufacturing centres

Melbourne, AUSTRALIA Inspired by tales told of fortunes "washed out" overnight, certain hardy young pioneers of Melbourne said to themselves "Perhaps we too have gold in the Australian Alps, at our very back door" Within two years they found it, not more that 50 miles away, and Melbourne, capital of the State of Victoria, Australia, only a small town then, became in ten years one of Australia's leading cities, and now ranks second in size only to Sydney

With untold wealth and an assured future in sight, hustling, ambitious Melbourne laid out its streets according to a carefully thought out plan, and now claims to have as fine public buildings as any city of its size in the world Melbourne's Town Hall has an auditorium which seats 2,500 people Its State Parliament buildings are in keeping with their importance Parks and public gardens are large, numerous, and well cared for

With its factories and banks, deep harbour, miles of wharves, both in the centre of the city and at Port Melbourne, and its dry docks, Melbourne is no longer the boom town of the

gold-mining rush Business is centred within a relatively small area bounded by streets 99 feet wide These include Collins Street and Flinders Street, the latter giving its name to one of the world's busiest railway stations The handsome residential suburbs extend for ten miles around the bay known as Port Phillip, after the sailor Captain Arthur Phillip Melbourne itself stands on the river Yarra at a point just before it enters Hobson's Bay.

In 1934 Melbourne (originally named after the famous Prime Minister of early Victorian days) celebrated its centenary A noble War Memorial for the State of Victoria was dedicated by the Duke of Gloucester It includes a Rock of Remembrance, so arranged that a shaft of light falls on it at 11 a m on Armistice Day

The population of the city is about 1,024,000

Melon. Melons fall into two main groups—musk-melons and water-melons The musk-melon (so named from its delightful flavour suggestive of musk) is probably a native of the subtropical parts of Asia The Egyptians grew it, and the Israelites even before the time of Moses The Romans and doubtless the Greeks were also familiar with it Today its many varieties are cultivated in the temperate and warm regions of the whole world, even in semi-desert places like Persia Of the many varieties the following are the most important —

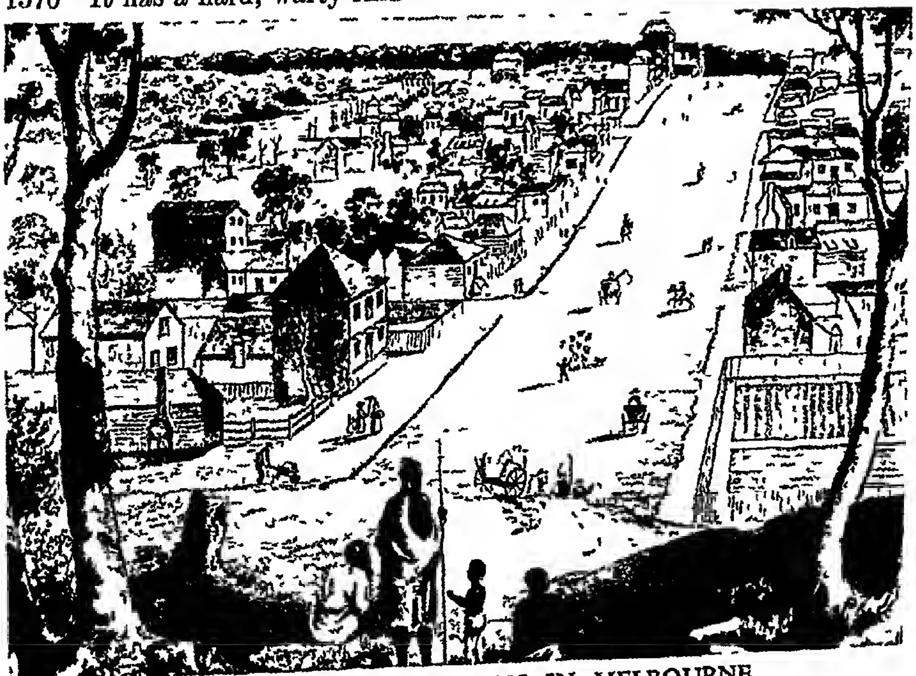
Cantaloup, or rock-melon, is a long-season variety that was named from Cantalupo, Italy, where it was first cultivated in Europe about 1570 It has a hard, warty rind

Nutmeg or netted melon matures sooner than the cantaloup, and has a softer rind

Cassaba or pine apple melon was first cultivated at Cassaba, Asia Minor, it is large and sweet, ripens late, and keeps well

Honey-dew is a large hybrid melon of exquisite flavour

The water-melon—a larger fruit with smooth dark-green, spotted or striped rind—is a native of tropical Africa The red, white, or yellow pulp of this cool, refreshing fruit, which often weighs from 20 to 50 lb and more, contains about 93 per cent water and 2 per cent sugar



A CENTURY OF PROGRESS IN MELBOURNE

The city of Melbourne was founded in 1835, two years before Queen Victoria came to the throne The drawing above was made five years later, and shows what is now Collins Street with the river Yarra on the left The photograph at the top of the page shows Collins Street as it is today, the principal street in the business quarter of a great city with a population of over 1,000,000

Courtesy of Australian Trade Publicity

CARGO OF MELONS FROM ASIA MINOR L N A

The melon is a native of Asia, and is still grown to a large extent in Asia Minor, whence these fruits are exported to Europe Here is a fine cargo of them of varying size and colour, that has just come across the Sea of Marmara to Istanbul, where they find ready purchasers

The "citron melon" is a small, round, rather solid form of the white-fleshed variety, used for preserving There is also a small variety about the size of an orange, pink-fleshed, called the "pomegranate melon"

The melon belongs to the gourd family, *Curcurbitaceae*, which includes also cucumbers, squashes, and pumpkins It is an annual trailing or trellis-climbing vine, growing best in rich, warm, turfy loam, well supplied with humus In cooler climates melons are grown in hothouses or hotbeds Scientific name of musk-melon, *Cucumis melo*, watermelon *Citrullus vulgaris*

Memnon. In Greek mythology, Memnon was the son of Eos (Aurora), goddess of the dawn, and king of the Ethiopians He came to the aid of Troy towards the end of the Trojan War, slew Antilochus, the son of Nestor, in single combat, and was himself slain by Achilles The colossal statues of King Amenhotep III of Egypt and his consort erected near Thebes were supposed by the Greeks to be sacred to Memnon One of them, after its partial destruction by an earthquake in 27 B C, was said to give out musical notes at sunrise Modern travellers who have heard the sound ascribe it to the rapid passage of the air through the pores of the stone when heated by the rays of the sun The Greeks called it the voice of Memnon hailing his mother

FAMOUS COLOSSI OF MEMNON Donald McLeish

These two great figures which stand on the west bank of the Nile at Thebes were erected about 3 000 years ago, and represent Pharaoh Amenhotep III and his consort That on the right was known to the Greeks and Romans as the statue of the god Memnon, and it is said to have emitted at sunrise a musical note now attributed to the action of the sun s heat on the cold stone The figures are about 65 ft high

Memory. Remembering is one of the most important things you do Yet ordinarily remembering is done with so little effort that you may not realize how complicated it actually is Psychologists define memory as the knowledge of an event or fact coupled with the further knowledge that the particular event or fact has been experienced in the past

To understand memory, we must split up the process into its several phases or parts Of these the first is called *association* This means the coming together of the two experiences so that the thought of one brings up

the thought of the other For instance, some time ago I saw two cars collide at the corner of the High Street and North Street When I pass that corner I think of the collision, but I do not associate *all* corners with collisions

The second phase of memory is known as *retention*, and refers to your power to retain associations in your mind It varies from individual to individual, and seems to be based upon a native quality of the nervous system The opposite of retention is *forgetting* We forget most in the first hour, less in the next, less in the next, and so on After the first 24 hours, the rate of forgetting is relatively slow

A student studying French, for instance, finds that he learns the meaning of 50 French words one day, the next day most of the words will be forgotten If, however, he practises the forgotten words the next day, and on succeeding days, in the course of time he will master the list completely In school we do not study arithmetic for one whole day, grammar the next day, and geography the next day, but we study arithmetic, grammar, and geography each day for short periods, in order that we may reinforce the memory bonds which have been weakened through the rapid forgetting that takes place during the first 24 hours

The third phase of memory is usually spoken of as *recall*, and refers to the ability of the individual to call up, under the appropriate circumstances, that which has been associated and retained If I ask you a question such as "What is 9 times 6?" you may immediately say "fifty-four," thus recalling what you have previously learned and have retained On the other hand, you may be unable to give an answer at the immediate moment, yet a few minutes later recall perfectly, thus indicating that the material has been retained

The ability to recall under appropriate circumstances is obviously the test of memory Thinking of the answer to a question in your examination paper after you have left the room is of little value in comparison with thinking of the answer when the question is asked The ability to recall depends in large part upon the number of associations which have been formed with the particular fact to be recalled The great opportunity for improving memory lies here Each association forms a "handle" by which to pick out of the storehouse of your brain the fact you need

The fourth phase of memory is called *recognition*, and refers to the "labelling" by which we assign the experience a place in our earlier life It is the feeling of "pastness" or familiarity Ordinarily, recall and recognition go hand in hand, occasionally, however, recognition occurs without recall A face may be familiar, yet call no name to mind

Persons differ in the kinds of things they remember easily Some remember things they have seen better than things they have heard, while others may do the reverse In good teaching, an attempt is made to present the material to the student in various ways he reads about it in a book, he discusses it in classes, he looks at diagrams and illustrations, and in some courses he actually works with the material in the field, the laboratory, or the workshop All these methods multiply the handles of association with which a person can remember the required fact when need arises

E N A

MENDEL, MONK AND SCIENTIST

By his experiments with plants, Mendel made a contribution to biology of first-rate importance which profoundly affected the theory of evolution, but he died before the importance of his discoveries was realized

Instead of the complicated systems for improving the memory which have been devised in the past, modern psychologists rely on a few simple principles Of these the first is that repetition tends to fix associations "Over and over again" is the best rule But repetition is not sufficient It is necessary to concentrate your attention upon what you are trying to learn You cannot learn a poem if you are thinking of a game of foot ball Interest in what you are learning is essential

Perhaps the foremost principle of efficient memorizing is the principle of recall during memorizing If, after reading, the student closes the book and tries to recall what he has read he will find his ability to retain much increased

If you outline what you are learning, run it over in your mind, discuss it with a friend—in other words, *do rather than merely receive*—you will find your memory greatly improved, particularly if the practice is kept up

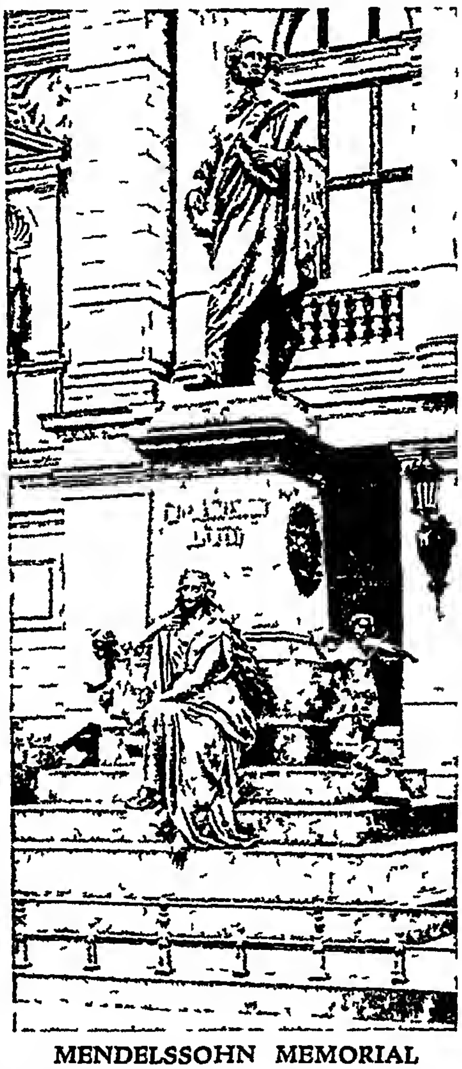
Mendel, GREGOR JOHANN (1822–1884) When Darwin and Huxley were astounding (and shocking) the worlds of science, philosophy, and religion by expounding the principles of evolution set out in the former's "Origin of Species" (1859) and "The Descent of *Man and*

Selection in Relation to Sex" (1871), an Augustinian monk and lecturer in natural history, at Brunn, Austria, was formulating and proving fundamental laws of heredity which, had they been known to Darwin and his fellow scientists, would have changed the whole course of biological science in the nineteenth century

The name of this monk was Gregor Johann Mendel, and the natural laws of heredity he discovered are always spoken of as the *Mendelian Laws* He was born at Heinzendorf, Silesia, July 22, 1822, and, studying for the priesthood, became an Augustinian monk in 1843 He was made abbot in 1860, and for fifteen years taught biology in the monastery school while pursuing his researches into hereditary characteristics

Seeking to record the reappearance in successive generations of "unit characters," Mendel chose for his experiments two contrasted types of the garden pea, the green and the yellow And he found that by crossing one variety with another, *i e* by *cross fertilization*, he produced hybrids or crosses in which only the one colour, yellow, appeared He thereupon called yellow the *dominant*, and green the *recessive* character, and he found, by further cultivation, that in the offspring of his "first crosses" 25 per cent showed pure dominant (yellow) character, 25 per cent pure recessive (green) character, while the remaining 50 per cent were hybrid like their parents, with yellow still dominant and green recessive Moreover, he discovered that the 25 per cent yellows reproduced only pure yellows and the 25 per cent greens only pure greens

In this manner Mendel established the principle of *segregation* in heredity, or the law which maintains pureness in the unit characters of a family The amazing thing is that Mendel's laws, found for peas, have since been found to hold good for many highly specialized plants and animals, even for some of the characters of Man himself—such as the colour of his hair and eyes, etc How wide the application is, especially for Man, has not yet been fully determined While Mendel's laws do not apply to all characters of plants and animals, they are known to be of sufficiently wide application to be of very great importance in the improvement of domestic plants and livestock



MENDELSSOHN MEMORIAL

This statue of Mendelssohn is in the city of Leipzig, with which he was closely connected for he was the first director of the Leipzig Conservatoire of Music

Unfortunately for science, Mendel's discoveries, which he published in 1866 and distributed to the chief scientific societies of the world, received no recognition, and it was not until 1900, when they were "discovered," that their immense value to agriculture and horticulture were fully realized It was then seen that the Mendelian Laws gave to breeders and growers definite guidance, and completely revolutionized all previous knowledge of heredity

The failure of his chief work to achieve the recognition it merited clouded the last ten years of Mendel's life, and he died, a disappointed man, January 6, 1884, at Brunn (*See* Heredity)

Men'delssohn, Jakob Ludwig Felix (1809–1847) Most great musicians have become famous in the face of handicaps, but in the case of Mendelssohn-Bartholdy (to give him his full name) there was never a day when he lacked anything that money or friends or education could supply His parents were wealthy and cultured Jews, whose home in Berlin was a meeting place for artists and scholars Felix Mendelssohn was born at Hamburg on February 3, 1809 At the age of four his lessons in music began, and at the age of nine he composed pieces for the family orchestra At seventeen he had his wonderful "Midsummer Night's Dream" overture performed When, at 20, in London, he conducted his Symphony in C for the piano enthusiasm ran wild

The account of Mendelssohn's life is a story of pleasant and profitable work His wonderful ability to extemporize and his willingness to play the compositions of other musicians made him a popular concert performer His own works were always in demand

His happy marriage duplicated the home experiences of his youth Among the friends of

his manhood were Jenny Lind, Schumann, Ferdinand Hiller, Moscheles, and his favourite sister Fanny The University of Leipzig honoured the great man by conferring on him the degree of doctor of philosophy, and there he organized what was so soon to become the famous musical conservatory of Leipzig He visited England ten times, and it was after the first visit that he toured Scotland, in 1829, and composed the famous Hebrides overture

No composer has enjoyed more general popularity The list of his compositions is long His oratorios " Saint Paul " and " Elijah " are sung everywhere His " Hymn of Praise " is familiar to all, as is his music to " A Midsummer Night's Dream," with its much used wedding march and nocturne, and his "Italian" symphony, his greatest composition His " Songs Without Words," including the " Spring Song " and " Bees' Wedding," are among the best-known of his other compositions

At the time of Mendelssohn's death the city of Leipzig was posted with funeral placards, and the hush that fell over the city was as if a king were dead Memorial services were held in practically every large city Seldom, indeed, has the death of a musician caused such deep and such genuine grief

The SIMPLE ART *of* MEASUREMENT

Hiding under the difficult name of " mensuration " is the very simple branch of arithmetic dealing with measuring lengths and surfaces Here are given some hints on this kind of calculation.

Mensuration. That branch of applied mathematics which deals with lengths, areas, and volumes we call *mensuration* (from Late Latin *mensuratio*, " measuring ") By the use of the tables and formulae of mensuration we may determine the area of a tract of land, the mass of a pyramid, or the weight of water in a large tank We may find the cost of painting the outside of a building, the number of bricks required to build a wall, the amount of gravel to surface a road

In measuring distances, and solving problems dependent on distances, linear measure is used, and in all cases it is necessary to reduce all figures to the lowest common measure Thus, if the problem is set in rods, yards, and feet, it will be found easier to reduce all to feet —

12 inches (in)	= 1 foot (ft)
3 feet	= 1 yard (yd)
$5\frac{1}{2}$ yards	= 1 rod (rd)
40 rods	= 1 furlong (f)
8 furlongs	= 1 mile (m)
5280 feet	= 1 mile

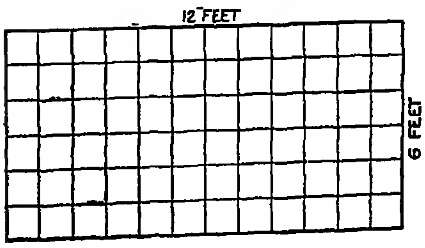


Fig 1

Problem How many feet of wire are needed to make a fence 6 wires high around a field 30 rds long and 20 rds wide ?

Solution $2(20+30)\times 16\ 5 \times 6\text{ft}$ = length of wire

Problem How many trees can be set, 20 ft apart each way, in a field 40 rds long and 200 yds wide ? $\frac{40\times 16\ 5}{20}\times\frac{200\times 3}{20}=$ number of trees

Solution

Plane surfaces (like a floor) are measured by finding the number of square units each contains, according to this table

144 square inches (sq in)	= 1 square foot (sq ft)
9 square feet	= 1 square yard (sq yd)
$30\frac{1}{4}$ square yards	= 1 square rod (sq rd)
40 square rods	= 1 rood
4 roods	= 1 acre (A)
640 acres	= 1 square mile (sq m)

Problem Find the area of a carpet 12 ft long and 6 ft wide Look at Fig 1, how many square feet are there in the upper row ? How many rows are there ? How many square feet in the six rows ?

Solution 6×12 sq ft $=72$ sq ft, the area of the carpet We see therefore that to find the area of a rectangular surface we must multiply the length by the width area $= l \times w$

Problem The area of a floor is 192 sq ft, one side is 12 ft Find the other side

Solution Divide the area by the given side thus $192 - 12 = 16$ ft

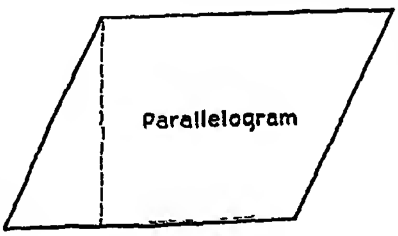


Fig 2

A practical application of surface measure is seen in this problem What will it cost to make a concrete path 6 ft wide and 150 ft long, at 10s a sq yd ?

Solution

$$\frac{6\times 150\times 10}{3\times 3}= \text{cost of path}$$

The area of the path is 6 times 150 sq ft, or 900 sq ft, divide by 9 to change to square yards The area is 100 sq yds The cost is 100 times 10s, or £50

A parallelogram has opposite sides equal In a parallelogram like Fig 2 the width is not the side, but the dotted line, which is called the *height* or *altitude* (alt) The formula for finding the area of a parallelogram is area = base × alt

A trapezoid, Fig 3, has two sides parallel Its area is alt × mean (or average) of the two bases

Problem Find the area of a trapezoid whose bases are 12 ft and 6 ft and altitude 6 ft

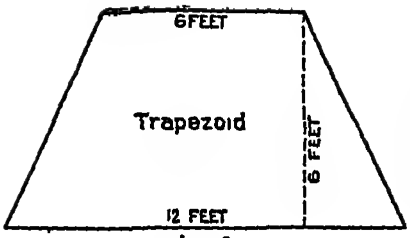


Fig 3

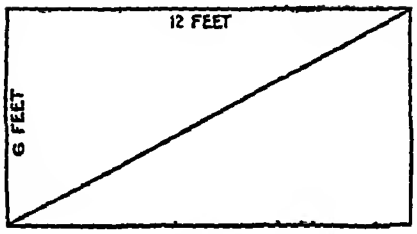


Fig 4

Solution $\frac{12+6}{2}\times 6=54$ The formula for finding the area of a trapezoid is area $=\frac{1}{2}$ sum of bases $\times$ alt

We see that the rectangle (parallelogram), Fig 4, is divided into two equal triangles The area of the rectangle is 6×12, or 72 sq ft The area of each triangle is $\frac{1}{2}$ of 72 sq ft, or 36 sq ft

The formula for finding the area of a triangle is area $=\frac{1}{2}$ base $\times$ alt

The circumference (C) of a circle is about three times the diameter (D) To be more exact, it is 3 1416 times the diameter The usual symbol for the number 3 1416 is the Greek letter *pi* or π) The formula for the diameter of a circle is $C=\pi\times D$ Conversely $D=C\div\pi$ A tree whose circumference is $8\frac{1}{2}$ ft has a diameter of 8 5$\div$3 1416, or 2 7056 ft

FINDING THE AREA OF A CIRCLE We may think of a circle as made up of a number of triangles which may be cut apart and then fitted together as in Fig 5 If we take enough triangles, we shall have almost a parallelogram, with one half of the circle's circumference for base and its radius for altitude, and equal in area to the circle Pushing this to the limit, to "flatten" the base, we can consider the result exact The area then is $\frac{1}{2}C\times R$ But $\frac{1}{2}C=\frac{1}{2}\times 2\pi R$, so the area $=\pi R^2$

Problem How much ground can a horse, tethered by a rope 100 ft long, graze over ?

Solution 100 ft is the radius of the circle over which the horse can graze The area of this circle equals π multiplied by the radius squared 3 1416$\times$100$\times$100=31,416 sq ft

TO FIND THE VOLUME, OR CUBIC CONTENT, OF A RECTANGULAR SOLID In the rectangular solid represented by Fig 6 we see that there are 5 layers, and each layer consists of 12 small cubes (4 times 3 cu ft), in the five layers there are 5 times 12 cu ft, or 60 cu ft

Cubic Measure is

1 728 cu ins = 1 cu ft
27 cu ft = 1 cu yd

Problem What will it cost to make the excavation for a basement 45 ft long, 30 ft wide, and 7 ft deep, at 5s a cu yd ?

Solution The volume of the earth removed is $45\times 30\times 7$, or 9,450 cu ft This, divided by 27 cu ft, equals 350 cu yds The cost is 350 times 5s, or £87 10s

We can see that the volume of a cylinder (Fig 7) is equal to the area of the base times the altitude, or height, remembering that the base of the cylinder is a circle

Problem Find the amount of water held in a cylindrical tank with a diameter of 6 ft and a length of 12 ft

Solution π times the square of the radius (3 ft) equals the area of the base, 12 times the area equals the volume, or the quantity of water the tank contains 3 1416$\times$3$\times$3$\times$12=339 2928 cu ft

We may wish to paint a cylinder Its total surface consists of two circles and the equivalent of a rectangle (the lateral surface unrolled)

Problem Find the cost of painting the outside of a cylinder 15 ft high and 8 ft in diameter, at 3d a sq ft

Solution 2 (3 1416 $\times$ 4 $\times$ 4) + (3 1416 $\times$ 8) $\times$ 15 $\times$ 3d = cost The area of each base (circle) is π (3 1416) times the radius (4) squared, or 50 2656 sq ft, the two bases, 100 5312 sq ft The circumference of the base ($\pi\times D$) is 3 1416 $\times$ 8 ft or 25 1328 ft Multiplying this by the height (15) gives us the area of the side surface of the cylinder, or 376 992 sq ft Adding this to the area of the two bases, we have the total surface, 477 5232 sq ft Multiplying 3d by this number gives the cost of painting, £5 19s 4d

A pyramid is a solid whose base is a polygon (figure bounded by three or more straight lines) and whose sides are triangles meeting at a point called the vertex The cube in Fig 8 is divided into six equal pyramids Now the volume of

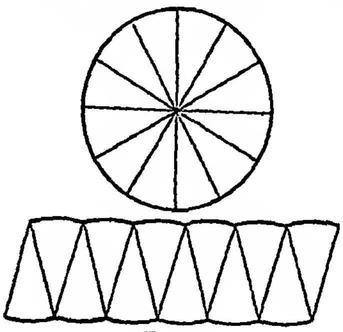


Fig 5

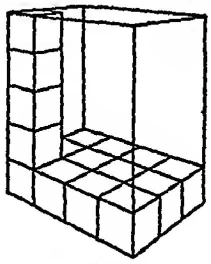


Fig 6

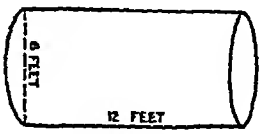


Fig 7

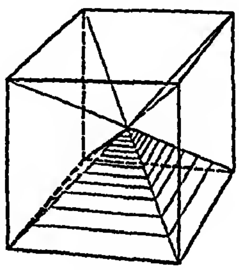


Fig 8

each pyramid must be $\frac{1}{6}$ the volume of the cube, and the volume of the cube is the area of one side times the height But the height of each pyramid is only half the height of the cube

Therefore the volume of each pyramid is $\frac{1}{3}$ the area of the base times the altitude

Problem Find the volume of a pyramid 5 ft square at the base and 12 ft high Solution $\frac{1}{3}(5 \times 5 \times 12) = 100$ cu ft

Find the area of the sides (external surface) of a pyramid 8 ft square at the base, and having a slant height of 10 ft Each of the four sides is a triangle, its area is $\frac{1}{2}$ (base $\times$ alt), but the altitude of each side is the slant height of the pyramid Hence, the area of all sides (convex surface) equals $\frac{1}{2}$ the slant height times the perimeter (the sum of the sides) of the base $\frac{1}{2}(4 \times 8 \times 10)$ = area of external surface = 160 sq ft

A cone is a solid having a circle for a base and tapering uniformly to a vertex Think of this as being a pyramid with an infinite number of sides to its base Obviously then the volume of a cone will equal $\frac{1}{3}$ the area of the base times the height

Problem How much earth is needed for a conical mound 42 ft in diameter at the base and 12 ft high?

Solution $\frac{1}{3}(3\,1416 \times 21 \times 21) \times 12 =$ 5541 7824 cu ft We multiply π by the radius (21) squared, multiply that result by 12, and find $\frac{1}{3}$ of this result

We considered the surface of a circle to be made up of a large number of triangles Similarly, we may think of the convex surface of a cone as made up of small figures that are practically triangles Hence, the area of the convex surface of a cone is equal to $\frac{1}{2}$ the slant height of the cone (which is the altitude or height of each triangle) times the perimeter of the base (a circle)

Problem Find the area of the convex surface of a cone which has a slant height of 10 ft and a diameter at the base of 12 ft

Solution $\frac{1}{2}(3\,1416 \times 12) \times 10$ sq ft = 188 496 sq ft

Suppose a pyramid or cone is cut through in a plane parallel to its base The remainder below is known as the frustum of the pyramid or cone Let us elaborate the frustum of a pyramid into the form of a solid whose base and top are formed by parallel polygons, and whose sides are therefore triangles or quadrilaterals Such a solid is called a prismoid, and the term includes among other things pyramids and frustums of pyramids The formula for finding the volume of a prismoid is of the greatest importance, since it holds true in many instances when the sides of the prismoid have become curved surfaces, as in a sphere, cylinder, cone, or frustum of a cone, it can be used to find the volume of many irregular objects

To find the Volume of a Prismoid Ascertain the area of the base and top surface, let us call them A and *a* respectively Call the area of the mid-section M, which is the area of the plane midway between, and parallel to the base and top Call the height H

$$\text{Then the volume} = \frac{H\,(A + a + 4M)}{6}$$

Volume measurements may be used to find the capacity of a bin or a tank and to determine the weight of materials

Problem Find the number of bushels (bu) that can be put into a bin 10 ft long, 8 ft wide, and 6 ft deep, allowing 8 bu to the cu ft

Solution $10 \times 8 \times 6 \times 8$ bu = 384 bu

Problem Find the number of gallons (gal) of water that can be stored in a cylindrical tank 14 ft in diameter and 11 ft deep, allowing 231 cu in to the gal The solution is as follows

$$\frac{3\,1416 \times 7 \times 7 \times 11 \times 1728}{231 \text{ cu in}} = 12{,}666\ 93 \text{ gals}$$

What is the weight of this water, at 62 5 lb to the cubic foot? $3\,1416 \times 7 \times 7 \times 11 \times 62\,5$ lb equals the weight of the water in the tank, or 105,832 65 lb

The weight of any mass is the weight of an equal volume of water times the substance's specific gravity

Problem Find the weight of a cylindrical section of marble 4 ft in diameter and 6 ft high, the specific gravity of marble being 2 688

$$\textit{Solution}\quad \frac{3\,1416 \times 2 \times 2 \times 6 \times 62\,5 \times 2\,688}{2000 \text{ lb}}$$

equals the weight of the marble in tons After finding the cubic contents of the marble we find the weight of an equal volume of water, then multiply by 2 688 Reduce this to tons by dividing by 2000 Answer, 6 334 tons

Think of a sphere (or ball) cut into two hemispheres (half spheres) which rest on their flat sides The area of the curved surface of each hemisphere is just twice the area of the circular base Hence the area of the curved surface of the whole sphere is equal to 4 times the area of this flat base of the hemisphere This area we can find from the diameter of the sphere

Problem Find the area of the surface of a sphere whose diameter is 6 ft

Solution $4 \times 3\,1416 \times 3 \times 3 = 113\,0976$ sq ft

We may think of a sphere as made up of a large number of pyramids whose height is the radius of the sphere, and the sum of whose bases is the surface of the sphere Hence, its volume is $\frac{1}{3}$ of the area of the surface times the radius

Problem Find the volume of a sphere whose radius is 8 ft

Solution $\frac{1}{3}(4 \times 3\,1416 \times 4 \times 4) \times 4 = 268\,08$ cu ft We first find the area of the surface, get $\frac{1}{3}$ of that, and multiply the result by the radius

Mental Deficiency. The dividing line between sanity and insanity cannot be finely drawn, and between the two we find a group of mental states which we now include under the heading mental deficiency

Mental deficiency is apparently more common or at least more readily detected among children than among adults It is commonly agreed that large numbers of children of school age are so mentally deficient that they cannot profit seriously from ordinary instruction These children seldom progress far in ordinary schools, and have to be transferred to specially organized schools for mental defectives where the teachers are qualified to deal with them

We may divide the mentally deficient into three general groups—idiots, imbeciles, and feeble minded The idiot group includes all those adults whose general intelligence is below the normal for a child of three years of age They are usually unable to feed or dress themselves or to avoid ordinary dangers, and they develop almost no command of speech Imbeciles are those whose intelligence corresponds to that of normal children between three and seven years of age They cannot progress beyond the early stages of school work, though they can perform simple industrial tasks under supervision They gain some command of language, but their ideas are very limited Imbeciles, like idiots, must usually be placed in an institution or receive constant care at home The feeble-minded have mental capacities like those of normal children between eight and twelve years of age (*See* Intelligence Tests) They may succeed in school work to a certain extent, but they do not show good judgement in managing their own affairs, and may become wayward or delinquent

Unfavourable heredity is the principal cause of mental deficiency, and is said to account for about two-thirds of all cases The remaining one-third are victims of accidents or of abnormal conditions such as disordered glandular function, birth injuries, or the after effects of certain serious diseases

Mercantile Marine. The development of the shipping industry on its commercial side is one of the greatest wonders of civilization In the first quarter of the 19th century there were not more than one hundred steamships owned in the United Kingdom, and it was not until 1819 that the first paddle steamship crossed the Atlantic Now there are over 29,000 steamships and motor-ships of all nations afloat, with an aggregate tonnage exceeding the huge figure of sixty-three million tons About one-third of these ships, and nearly one third of the world's tonnage, are British-owned In addition, there are over 1,900 sailing vessels of over 100 tons Large liners are now increasingly using oil as fuel

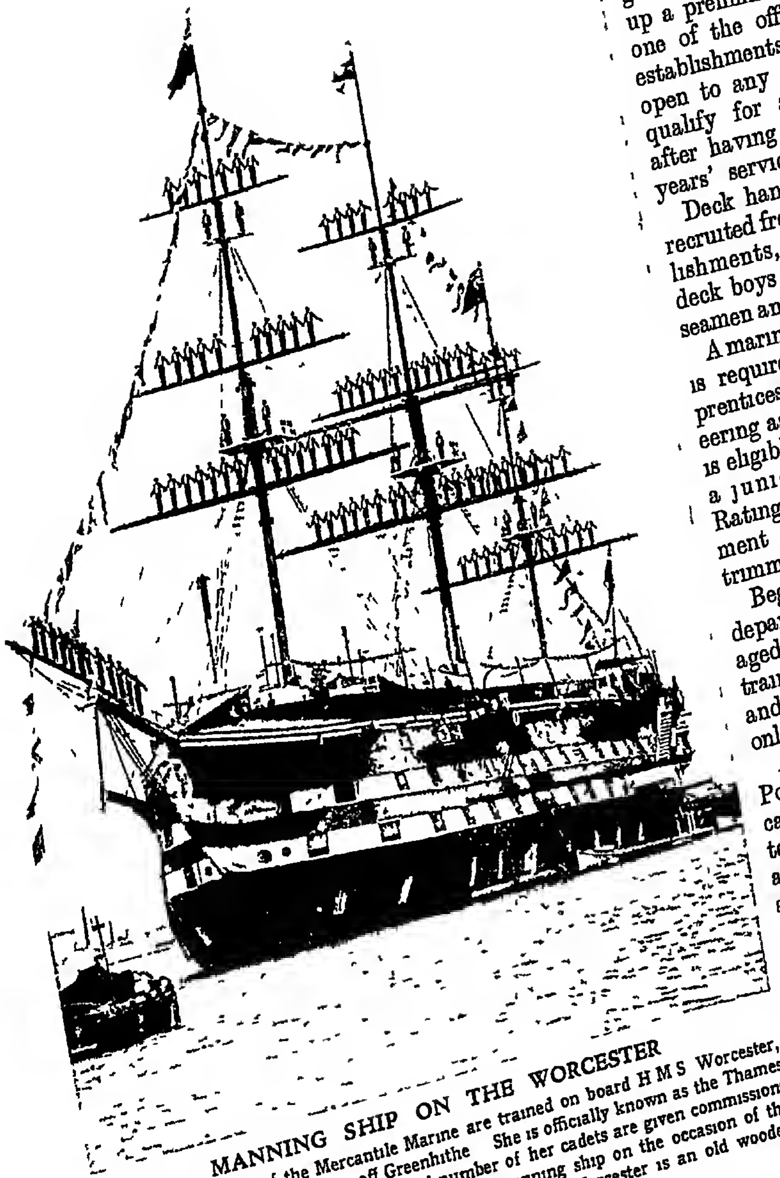
Standard Cap Badge of Mercantile Marine

The importance of the mercantile marine to Great Britain can hardly be exaggerated In every port of the world the Red Ensign with the Union Jack in the corner is to be found flying from the stern of British ships On every sea and waterway, on the loneliest ocean tracks as on the great trade routes, one may meet British tramp steamers, many of which have not touched at a home port for several years

MERCANTILE OFFICERS TO BE

These cadets on board the training ship Conway, moored in the Mersey, are learning to box the compass as a part of their course in navigation Boxing the compass means repeating all the 32 points in their proper order

Our mercantile marine is responsible for a large part of what economists term "invisible exports," *i e*, the services rendered in all parts of the world by thousands of British ships are paid for, in goods or money, by the countries concerned For example, say Argentina needs locomotives and steel rails She can get these best and cheapest in England, and orders them accordingly, and when they are ready they are shipped to Buenos Aires in a British ship, or "bottom," as it is sometimes called Arrived there, the ship is chartered by an Argentine firm to carry grain, meat, or hides back to England, or, it may be, to load up with wheat for China In either case the ship is earning freight money for the services rendered If, then, you multiply such earning power many thousand-fold a year, you will readily see how your mercantile marine provides employment for British seamen and earns millions annually,



MANNING SHIP ON THE WORCESTER

Many of the cadets of the Mercantile Marine are trained on board H M S Worcester, which is moored in the Thames off Greenhithe She is officially known as the Thames Nautical Training College, and a limited number of her cadets are given commissions in the Royal Navy The cadets are here seen manning ship on the occasion of the prize-giving by the First Lord of the Admiralty The Worcester is an old wooden man-of-war or "ship of the line"

much in the same way as British money invested in foreign concerns earns dividends

To keep the British mercantile marine supreme not only requires the enterprise of owners and the craft of shipbuilders in constructing new and bigger steamers to meet the competition of the subsidized shipping of the rest of the world, it also necessitates the maintenance of an efficient and highly-trained sea-going personnel

The mercantile marine offers four avenues of employment to British boys service on deck, in the engine room, and in the catering and wireless departments

To become a navigating officer it is usual to serve four years' apprenticeship, either going to sea direct or taking up a preliminary training in one of the officers' training establishments It is also open to any deck rating to qualify for a ship's officer after having completed four years' service at sea

Deck hands are generally recruited from training establishments, commencing as deck boys and rising to able seamen and petty officers

A marine engineering officer is required to serve an apprenticeship in general engineering ashore, after which he is eligible for employment as a junior engineer officer Ratings in the engine department usually commence as trimmers

Beginners in the catering department are also encouraged to undergo preliminary training before going to sea, and many companies take only trained boys

A radio officer must hold a Postmaster-General's certificate of proficiency in wireless telegraphy, which necessitates about twelve months' study at a wireless college

Mercerizing. John Mercer, an English dealer in cloth, announced in 1844 the chemical process which made cotton cloth look like silk, and today his name is perpetuated in the trade term "mercerized" silk The process consists in steeping the fabric, yarn, or thread in a solution of alkali (caustic soda or caustic potash) in a cool temperature, then putting it under tension, and, lastly, rinsing it The process entails a shrinkage in bulk of about one quarter The cotton fibres, which were originally mere flattened spiral tubes, are drawn closer and made straight and translucent, so that they present a smooth surface that reflects the light with silk-like lustre In the genuine process, which is expensive, the finish will not vanish when laundered Cotton cloth thus treated is softer and stronger, and takes more brilliant

colours when dyeing Sometimes a variation in the caustic soda process is employed to give the modern crimped or crêpe effect

Mercer, who was originally a bobbin-winder, made many other important chemical discoveries

'Merchant of Venice.' In this comedy Shakespeare portrays the magnificent womanhood of Portia against the dark, malignant power of Shylock, the Jew Bassanio, soldier and scholar, and the "best deserving of a fair lady", Gratiano, the madcap wit in his following, Jessica, that "most beautiful pagan, most sweet Jew," daughter of Shylock, and the "merchant of Venice" himself—Antonio, "the kindest man"—form a galaxy of stars in this enthralling play The main plot concerns the discomfiting of Shylock, who wishes to enforce against Antonio the latter's bond to give one pound of his flesh in default of payment of a loan Portia discovers a law forbidding a Jew to shed Christian blood, and successfully pleads in court that the bond cannot be enforced "If the scale do turn but in the estimation of a hair, thou diest," she warns Shylock This play contains some of the greatest passages in Shakespeare One of these is Portia's matchless lines in reply to Shylock

The quality of mercy is not strained,
It droppeth as the gentle rain from heaven
Upon the place beneath it is twice blest
It blesseth him that gives, and him that takes
'Tis mightiest in the mightiest it becomes
The throned monarch better than his crown
His sceptre shows the force of temporal power,
The attribute to awe and majesty,
Wherein doth sit the fear and dread of kings,
But mercy is above this sceptred sway,
It is enthroned in the hearts of kings,
It is an attribute of God himself,
And earthly power doth then show likest God's
When mercy seasons justice Therefore, Jew,
Though justice be thy plea, consider this,
That in the course of justice none of us
Should see salvation we do pray for mercy,
And that same prayer doth teach us all to render
The deeds of mercy

Mercury. This is the only metallic element that is fluid at ordinary temperatures It is from this fact that it receives its common name "quicksilver," meaning "live" or fluid silver The name "mercury" is given it from the fleet-footed Roman god Mercury

Pour a little of this silvery-white metal on a piece of paper, and you will readily see how the name fits it No matter how much you pour out, it will not spread like water, but clings together in a flattened ball If you break up this ball, the portions promptly form smaller balls If you bring the portions near one another again they will run together and form larger balls, because they have a strong attraction for one another Though quicksilver is a liquid, it will not wet paper, because it is much denser than paper—so dense, in fact, that only gold and a few of the rarer metals surpass it in specific gravity

Heat expands mercury, and cold contracts it regularly down to its freezing-point, which is about 40 degrees below zero (Fahrenheit) This explains the use of mercury in a thermometer, the range being more than 700 degrees between its boiling- and freezing-points Mercury is evaporating at all times, just as water evaporates, but the vapour is invisible

Native mercury is found in small quantities, usually in connexion with mercurial

A SCENE FROM 'THE MERCHANT OF VENICE'
In the first scene of the third act of 'The Merchant of Venice,' Shylock meets Salanio and Salarino, two friends of Antonio, in a street in Venice and tells them of his determination to enforce his bond against Antonio The bond provided that if Antonio did not return Shylock's loan of 3,000 ducats the forfeit would be "an equal pound of your fair flesh, to be cut off and taken in what part of your body pleaseth me"
From the water colour by Sir John Gilbert Victoria & Albert Museum

ores These ores, of which the most important is called cinnabar, are burned in a furnace, and the sulphur which they contain passes off as sulphur dioxide (SO_2) The mercury is collected in a condensing chamber It is then filtered through chamois-skin to purify it, and packed in 75-lb flasks for the market

The Greeks and the Phoenicians procured cinnabar from Almaden, Spain, where a mine is said to have been worked since 800 B C Spain, Italy, Mexico, Russia, Czechoslovakia, China, Peru, and the United States now produce it

Mercury readily unites with other metals to form what are called amalgams, and this property is made use of in extracting gold and silver from their ores The amalgam of mercury and tin is used in silvering mirrors, while others are used in gilding and in filling teeth Mercury is used largely in making instruments such as barometers and thermometers Since mercury is a good conductor of electricity, it is used for making contacts in thermostats and for power control switches Mercury vapour is used in electric lamps of the ultra-violet ray type

Other industrial uses are in the manufacture of fulminates used in cartridges, in solders, in making pigments, such as vermilion red, in fireworks, for wood preservatives, and for anti-fouling marine paints

Drugs and chemicals account for almost 40 per cent of the total consumption of mercury A familiar example is calomel (mercurous chloride HgCl) This should not be confused with the bichloride of mercury ($HgCl_2$), called corrosive sublimate, one of the most powerful antiseptics and also one of the deadliest poisons known

In Roman mythology Mercury was the god of merchandise and of merchants He was identified with the Greek god Hermes (*See* illus page 2080) The innermost planet of the solar system is named after him (*See* Planets)

Meredith, GEORGE (1828–1909) This great English novelist and poet was born in Portsmouth on February 12, 1828, and died on May 18, 1909, in the cottage on Box Hill, near Dorking, where he had spent his later years

The extraordinary length of his working life as a writer is shown by the fact that his first literary contribution to appear in print was accepted sixty years before his death, having been published in "Chambers's Journal" in 1849 It took him many many years to gain recognition, indeed, for a very long time he was neglected by the reading public, although younger writers recognized him as a great artist, and were powerfully influenced by his individual philosophy

In old age, however, he was regarded as one of the greatest men of letters, deafness and partial paralysis did not impair the brilliance of his mind English literature would be immeasurably poorer without such masterpieces as "The Ordeal of Richard Feverel," "The Egoist," and "Diana of the Crossways"—to mention only three of his works

GEORGE MEREDITH
Meredith represented a great literary period, and his handsome appearance and brilliant conversational powers made him a famous figure in late Victorian times

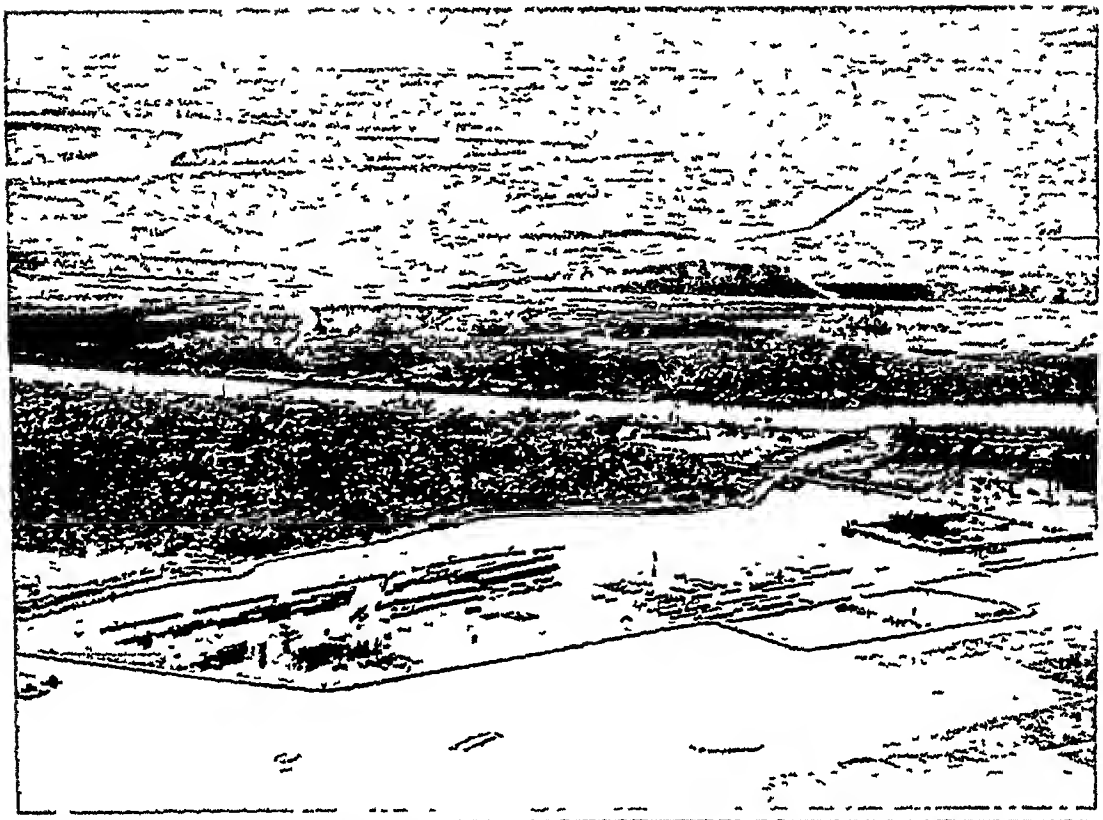
Merionethshire, WALES The county of Merionethshire, facing the north end of Cardigan Bay, contains some of the most beautiful mountain scenery in Wales

The estuary that stretches between Barmouth and Dolgelly, in particular, furnishes an unrivalled panorama of swelling mountains and placid water, and the walk between these two towns was described by Ruskin as the finest in Great Britain Cader Idris, nearly 3,000 ft high, and beloved by mountain climbers and tourists, can be ascended from either Barmouth or Dolgelly The rivers include the Dee, which has its principal source in Lake Bala, and the Dovey

The county, which has an area of 660 square miles, is practically all mountainous, and agriculture is backward, although there are many small farms Dolgelly (population, 2,260) is the county town, other towns are Barmouth, Festiniog, Harlech (famed for its ruined castle and its place in national song), and Towyn The population of the county is about 43,000

Mermaids. Even to this day some superstitious people believe in the existence of these "sea-maidens," and fancy that they have seen them coming up from the deep, or seated on the rocks The mermaid is usually represented as a lovely woman with a human head and body ending in the scaly tail of a fish Often she combs her long beautiful hair with a comb of gold or pearl, while she holds a mirror above the waves to catch her image Many stories are told of mermaids enticing human lovers to the depths of the sea One of the legends told of the Lorelei rock on the river Rhine is of a singing siren There are also tales of their leaving their ocean home and gaining a human form

Mesopota'mia. This is the name given to the land lying north-west of the Persian Gulf between the rivers Tigris and Euphrates It is a fertile alluvial plain originally formed from the silt brought down by the two rivers Tradition



MESOPOTAMIAN FLOODS

The two great rivers of Mesopotamia are the Tigris and the Euphrates, and the level of the land under normal conditions is very little higher than the rivers The photograph shows the Tigris in flood at Baghdad

Photo Royal Air Force (Crown Copyright)

has it that the Garden of Eden was placed somewhere in this rich area

So fertile is this region that the barbarian nomads roaming with their herds over the pasture lands of the Arabian Desert on the west or the uplands of what is now Persia and Turkey on the east and north looked upon it with unending desire Successive tribes swept down into it and fought for its possession at the beginning of history, founding their nations and falling in turn before more powerful foes (*See* Babylonia)

Archaeologists have found on the Plain of Shinar, at the south of the old basin, remains going back as far as 5000 B C In that era the Sumerians, a non-Semitic people from the east, quitted their wandering tent-living existence and settled here to till the soil, build houses, construct irrigation systems, form governments, and create a civilization—perhaps the first in the world It is still a matter of dispute among archaeologists whether the civilization of Egypt

RECOVERED FROM MESOPOTAMIA'S DUST

Every year life in the Mesopotamia of 3,500 years ago is being made more real to us by archaeologists' discoveries For instance, in the outer chamber of a royal tomb 74 bodies were found and the floor was strewn with gold and silver ornaments, including this headdress Experts reconstructed it and mounted it on a female skull of the period to show us what a lady of the court of Ur must have looked like

Courtesy Joint Expedition to Ur

or that of Sumer came first, and to what extent the one is indebted to the other

These Sumerians, whose cuneiform writing on clay tablets preserved their history, made great strides in the centuries they tilled this land Their great cities flourished long before the dawn of history Each of the strong Semitic desert tribes that conquered Mesopotamia during the next 2,000 years absorbed the Sumerian civilization and added to its lustre as they brought under their rule the whole of the fertile crescent that circles the desert The Akkadians excelled in sculpture The first Babylonian Empire advanced commerce and banking, and handed the arch down to the great builders of the Assyrian Empire, whose first iron-equipped legions swept the crescent Kish, and then Babylon, became great capitals, and fell as Assur and Nineveh gained in power Nineveh left us the first known library Babylon rose again after Assyria had destroyed it, rebuilt upon a grander scale by the Chaldean emperor Nebuchadrezzar (*See* Babylon)

The story of how the spade has uncovered the ruins of Mesopotamia, from the time when Layard laid bare the city of Nineveh down to our own day, when Sir Leonard Woolley has explored the ancient civilization of Ur, is one of the romances of archaeology

About 600 B C the Indo-European peoples from the northern grasslands, who later conquered and settled all Europe, started to drive the Semites from this prized territory The Medes first took Assyria, then fell before Cyrus the Great, as the Persians spread their empire to the Mediterranean, entering Babylon in 539 B C Alexander the Great died at Babylon in 323 B C after adding this land to his many conquests Then Roman legions trampled the soil, but gave way in A D 363 before Persia, whose Sassanid kings established their capital at Ctesiphon Finally a Semite people took Mesopotamia again in the 7th century A D as the Mahomedan religion swept the Arabs into world power Their caliphs built dazzling Baghdad for their capital

Ruinous Rule of the Turks

The rise and fall of kings and nations meant little to the farmers ploughing the fertile soil irrigated by long canals from the two rivers Their rich crops paid for palaces and temples and armies, but the busy people cared little who ruled so long as the water flowed freely The Mongol invasions began in the 13th century Tamerlane's raid in 1393 almost depopulated Baghdad Mongol hordes pouring in from the east destroyed the precious canals as they ravaged far and wide The country did not pass completely into the power of the Ottoman Turks until 1638, but Mesopotamia never regained its ancient fertility, wealth, and splendour The ruinous rule of the Ottomans lasted from 1638 until the end of the World War, when a new nation, Iraq, was formed and Emir Feisal declared king (*See* Iraq)

Metals. About three-fourths of the ninety-two elements are classified as metals To the chemist, an element is a metal if its oxide forms a base with water, as do sodium and iron, and a non-metal if its oxide forms an acid with water, as do sulphur and phosphorus (*See* Acids and Alkalis) Yet the line cannot be sharply drawn between metals and non-metals, for some elements, like arsenic and antimony, have properties characteristic of both

Ordinarily we think of metals as having certain properties, such as weight, hardness, malleability, ductility, and as having a crystalline structure capable of taking a polish, and as being good conductors of heat and electricity But not all metals have these properties Mercury is a liquid antimony and bismuth are brittle, sodium and potassium are extremely soft, lithium weighs little more than half as much as water Metals vary greatly in their melting-points, from mercury, which melts from the frozen state to a liquid at 37° F below zero, to tungsten, which is believed to melt at about 5,900° F They also vary in chemical activity some metals, like potassium and sodium, combine vigorously with even cold water, some, like gold and platinum, react only with the strongest and most active chemical agents

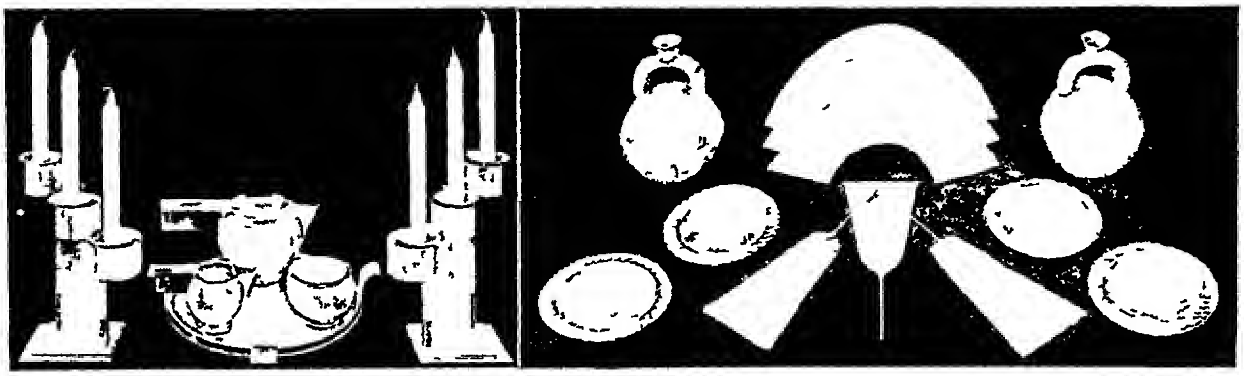
Properties of Pure Metals

Many metals have properties in the pure state that are undesirable to Man, and as a consequence most of the metals we see in common use are either alloys or compounds Table silver, pennies, solder, bronze, the metals of tools and machinery, of buildings and locomotives, are alloys Pure iron, for example, is too soft to be of much value, therefore steel, an alloy, is more generally used Small quantities of other metals such as chromium are sometimes alloyed with steel for hardness

Some metals are found in the pure state, but by far the greater part of them are in combination with other elements in the form of sulphides, oxides, carbonates, and silicates, usually mixed with rock and earthy materials (*See* Minerals) Lead, zinc, iron, copper, chromium, nickel, and mercury are among the common metals found in combination in ores Some metals are quite rare, and tons of ore must be treated to recover even a small amount of the pure metal Among the rare metals are rubidium, titanium, caesium and radium

The recovery of metals from their ores is the science of metallurgy, involving many mechanical and chemical processes

Few metals are necessary to either plant or animal life The important exceptions are iron,



WORK IN PRECIOUS METALS BY ANCIENT AND MODERN SMITHS

On the left is some modern silver, typical of a fine type of 20th-century work and gold ornaments made centuries ago by Peruvian metal workers. On the right are gold plates and water bottles, Below are two Chinese "iron pictures"

a constituent of blood, calcium, which as a phosphate forms the greater part of the bony structure, sodium, potassium, and magnesium. Of secondary importance to life are copper, aluminium, and manganese. Minute quantities of them are found in the average balanced diet.

Metal Working. Many thousands of years ago men pierced bits of gold for beads or hammered them into crude ornaments—probably the first use of the first metal known. In a later age, but so long ago that we cannot date it, copper was discovered.

Copper ushered in the Age of Metal, the beginning of a long and amazing development that has given us thousands of products—the steel framework of our giant buildings, our locomotives, motor cars, and aeroplanes, and innumerable machines to make the world's goods in quantities.

Both utensils and weapons were made of copper, and when it was discovered, probably by accident, that the admixture of tin formed a hard bronze, metal working was given an impetus that has lasted until today. Bronze made excellent castings, and was used by the Assyrians, Egyptians, Cretans, Greeks, and Romans for statues and ornaments, as well as for commoner articles. Museums show an astonishing array of Bronze Age relics. (*See* Bronze)

In later European times metal workers produced such works of art as the tomb of Maximilian I in Vienna, with its 28 bronze statues, executed by Peter Vischer of Nuremberg, or the colossal Perseus in Florence, by Benvenuto Cellini. Ponderous church doors, great bells, candlesticks, crucifixes, shrines, altars, fonts, inkstands, door knockers, hinges, and handles were cast in bronze and worked by artists of note. Cellini, Lorenzo Ghiberti, and Michelangelo in Italy, and Germain Pilon and Jean Goujon in France distinguished themselves as consummate artists in metal.

Brass, an alloy of copper and zinc, was little used until the Middle Ages. Then followed brass castings and *repousse* (relief) work. Pulpits and lecterns, often topped by eagles, pelicans, or griffins in brass, massive candlesticks, and chandeliers were made for churches. Fire-dogs, wall sconces, locks, and utensils were made by the brass workers. (*See* Copper)

Gold and silver were used by nearly all the ancients for jewelry, coins, and vessels. In later times European goldsmiths produced such notable pieces as the gold cross of Justin II and Sophia in St Peter's, Rome, the Gourdon gold chalice and paten, the chalice by Duccio of Siena, and the Cross of the Angels at Oviedo, Spain. Table service was crowded with the ornamental detail of the Renaissance, like the Cellini salt-cellar made for Francis I, or was of austere simplicity like that of 18th-century Georgian England.

Lead was used by the Greeks for statuary, and the Romans used it for water pipes. English lead coffins showed fine artistry, and retainers' badges from feudal times are to be found in all museums. Probably the highest artistic employment of lead is in English garden statuary. Lead has many uses because it is durable.

Pewter, originally an alloy of tin and lead, but now usually of tin, copper, and antimony, became a favourite medium. The Chinese, Chaldeans, Egyptians, and Greeks probably worked with it, and it was used by the Romans during their English occupation. Durable and yielding to shaping, it found wide use for tableware and decorative objects as early as the 14th century. Continental workers produced many beautiful plates and vessels of pewter, but British craftsmen used it more extensively. In Elizabethan times it was common for cooking utensils, flagons, communion services and table sets.

Iron responds readily to working and artistic treatment. Iron supplanted the softer bronze

for weapons, and legends grew up about swords and the great smiths who made them By the mid-16th century the European armourer occupied the highest place among the craftsmen With the Renaissance the trade began to die

Iron had other uses than for weapons and armour It was used by the Assyrians and Egyptians, and by Roman times was in common use for both practical and artistic purposes In the Middle Ages and later we find firebacks, fireplace implements, ornate lanterns, escutcheons, candlesticks, and screens of intricate design Massive doors with heavy iron mountings, hinges rich in ornamental design, intricate locks, and formidable knockers add to the impressiveness of many historic buildings Elaborate gates and grilles, such as that protecting the tomb of Edward IV in St George's Chapel, Windsor, are to be found throughout Europe Similar modern work is popular

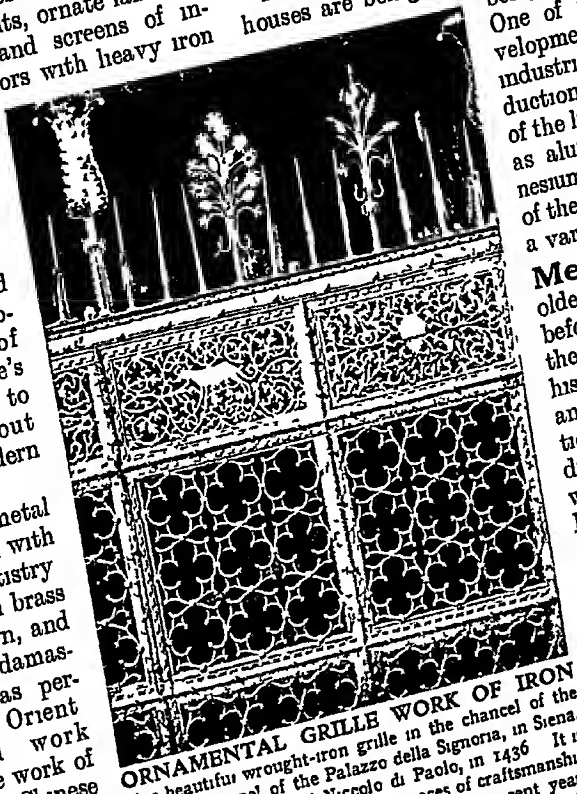
In the Orient, metal work was developed with a high degree of artistry Persian and Indian brass work is well known, and the fine tracery of damascened objects was perfected in the Orient Unusual gold work characterizes the work of the Javanese The Chinese produced brass and bronze art, some of exceptional beauty, in many different periods, now sought by collectors Their 17th-century iron work is most unusual, pictures being made on screens with the metal, achieving lines and effects of almost unbelievable fineness and grace

The Japanese drew upon China in many of their artistic endeavours, but many of their techniques are their own Iron sword guards show originality of design, while many bronze articles, particularly vases, trays, and small figures, are collectors' items Artists developed coloured metallic alloys for inlay purposes, and utilized such unusual methods as cloisonné (*see* Enamelling), inlays in middle relief, and decorations in high relief, sometimes cast with the object Today excellent work is being done in silver vases, incense burners, bowls, in strangely realistic figure groups, and in hammered work (*See* Japanese Art)

In European countries ornamental metal working still holds a prominent place Germany gave a new stimulus to silverware manufacture by working out designs that took into consideration both the limitations and capabilities of machines

Germany also startled the world with tables, chairs, and other furniture of metal, and was soon joined by other countries, and nowadays we have a great deal of metal furniture using aluminium tubing, bronze, chromium plate, etc

Metals are being used to a larger extent, even houses are being constructed with metal members, like sky-scrapers One of the modern developments in the metal industries is the introduction and improvement of the lighter metals, such as aluminium and magnesium, and the adaptation of them, or their alloys, to a variety of special uses



ORNAMENTAL GRILLE WORK OF IRON

This beautiful wrought-iron grille in the chancel of the Consiglio Chapel of the Palazzo della Signoria, in Siena, Italy, was the work of Niccolo di Paolo, in 1436 It is typical of hundreds of other such pieces of craftsmanship to be found in many cities of Europe In recent years architects have again made extensive use of hand-wrought iron in grilles, gates, and railings

Meteorology. In olden times the fisherman, before going to sea, and the farmer, before cutting his hay, looked at the sky, and from their observation and judgement deduced what the weather was likely to be that day In our time meteorology (the science of "things in the air," *i e* atmospheric phenomena) is more complex, and its posts of observation and its channels of communication now cover the whole earth, the former include many ships at sea

There are two branches of this science which are of general interest—the forecasting of the weather for a period ahead, and the keeping of rainfall and other weather records The British Meteorological Office existed as a branch of the Board of Trade from 1854 to 1919, when the office was attached to the Air Ministry Daily forecasts of the weather for the next 24 hours are regularly issued (with, usually, a "further outlook" for another 24 hours), and are published in the newspapers throughout the length and breadth of Great Britain Recently the distribution of this important information has obtained a new ally in wireless, and every day hundreds of thousands of people "listen in" to the weather forecast in their own homes Every pilot on the air routes finds out from the airport

meteorological office, before taking off, what sort of weather to expect

Under the auspices of the Royal Meteorological Society the whole country is covered by an organization in connexion with which observers take daily records of rainfall, direction of the wind, etc, at hundreds of different stations These observations are taken in Europe at 1 a m, 7 a m, 1 p m, and 6 p m The chief British observatory is at Kew

The records of British weather are carefully compiled in the form of an annual report, which is of a most interesting character For one thing, such records show in a very striking way the extraordinary variation of the annual rainfall in different parts of the country—some places having nearly ten times as much rain as others

The following weather forecast and map was issued on November 29, 1937, and is reprinted from "The Daily Telegraph and Morning Post"

TODAY'S WEATHER

LONDON, S E & E ENGLAND, E MIDLANDS —Light or mod S E to S winds, fair after fog locally at first, average temperature

S W & N W ENGLAND, W MIDLANDS, WALES —Fresh or strong S wind, mainly fair, average temperature

N E ENGLAND, N MIDLANDS, S E SCOTLAND Mod S winds, fair, local fog, average day temperature

REST OF SCOTLAND, ISLE OF MAN, ORKNEY & SHETLAND, IRELAND —Strong S to S W winds, a gale locally, fair at first, occasional rain later, rather mild

ENGLISH CHANNEL —Sea slight

FURTHER OUTLOOK —Changeable in W and N, fair in S E

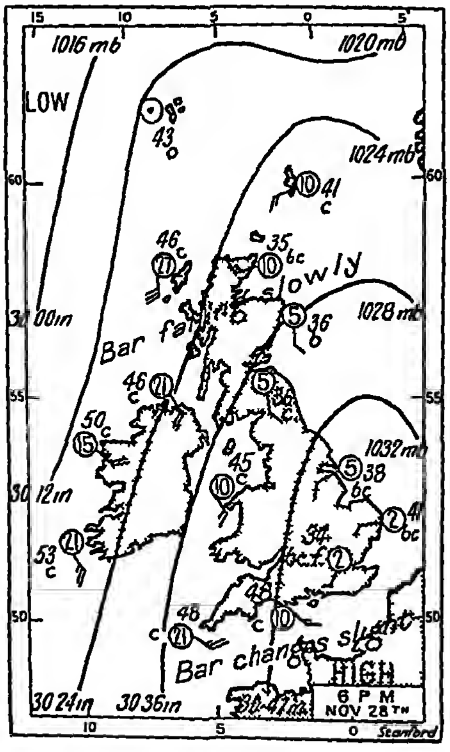
AIR ROUTES TO CONTINENT —Wind variable, less than 10 m p h up to 3,000 ft, increasing Fog early in most places Small amounts of cloud apart from drifted fog Visibility early less than 100 yds in many places, improving in most places to 1 3 miles during the day

High water London Bridge 11 17 a m 11 44 p m
Lighting up time 4 24 p m
Sun rises 7 42 a m sets 3 54 p m
Moon rises 4 7 a m sets 1 57 p m

Anticyclone covering S E England and N France is moving South Weather will become unsettled in West and North with occasional rain later In South and East weather will be fair after fog in places at first

AIR MINISTRY'S WEATHER CHART

This weather chart is exhibited daily at the Air Ministry, Kingsway, London The white continuous lines are isobars while the round labels, indicating meteorological stations bear details of force and direction of wind, visibility, and type of weather at those stations Below is a specimen of the daily weather maps that appear in our newspapers



ATMOSPHERIC PRESSURE —The continuous lines are isobars At all places at sea level on any one of these lines the pressure (or height of the barometer) is the same—namely that given in millibars and inches at the end of the line (1 000 mb = 29 53 in) Regions of high and low pressure are indicated by the words High and Low respectively When a heavy arrow is drawn outwards from a low pressure centre its direction indicates the expected direction of movements of the system, and its point indicates the expected position of the centre at six o clock (G M T) this morning

Wind —Direction is shown by arrows flying with the wind, and force is shown by the figures within the circles which indicate the velocity in miles per hour near the ground and by the number of feathers on the arrows as follows ½ Light Air 1 Slight Breeze 1½ Gentle Breeze 2 Moderate Wind 2½ Fresh Wind 3 Strong Wind 3½ High Wind 4 Gale 4½ Strong Gale 5 Whole Gale 5½ Storm 6 Hurricane

TEMPERATURE in degrees Fahrenheit is shown by the figures

WEATHER CONDITIONS are indicated by letters near the small circles bc Blue Sky hc Sky half clouded, c Cloudy d Drizzle f Fog g Gloom l Lightning, m Mist o Overcast, p Passing Shower, q Squalls r Rain h Hail rs Sleet, s, Snow, t Thunder, thr Thunderstorm u Ugly threatening sky y Haze

The scale of wind force and the lettered abbreviations for weather conditions were both introduced by Rear-Admiral Sir F Beaufort (1774–1857)

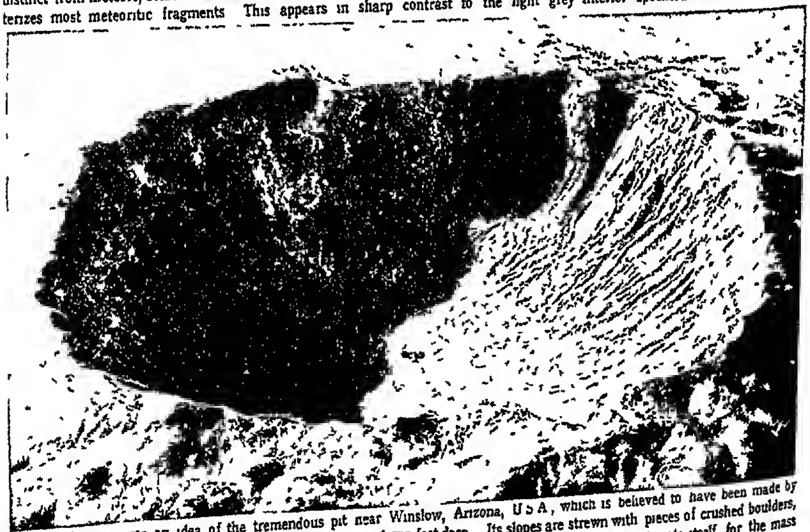
The daily newspapers also publish a summary of the previous day's weather, and a table showing the hours of sunshine recorded at health resorts (*See also* Climate, Cyclone)

Meteors AND METEORITES On many clear nights when there is no moon you may see "shooting stars"—those objects that flash brightly across the heavens for a brief second and are gone Actually they are not stars at

METEOR'S FLIGHT AND METEORITE'S GRAVE

A meteor ordinarily travels quietly along in its regular orbit through space, as shown above But when it nears a planet such as our earth it plunges headlong towards its great neighbour Its passage across the sky is often followed by a sound like distant thunder

Heat caused by friction with the earth's atmosphere, which resists such terrific speed, ignites the rushing mass, so that it is seen a a streak of fire But the flaming trail lasts only a few seconds, for the meteor bursts against the air pressure Meteorites, which ar distinct from meteors, sometimes reach the earth Evidence of their fiery flight is found in the glossy black crust which chara terizes most meteoritic fragments This appears in sharp contrast to the light grey interior speckled with metallic iro



This aerial view gives an idea of the tremendous pit near Winslow, Arizona, U S A, which is believed to have been made by a meteorite The crater yawns four-fifths of a mile wide and 570 feet deep Its slopes are strewn with pieces of crushed boulders, and meteoritic iron is scattered within a five-mile radius outside Scientists are digging for the meteorite itself for the mass which hollowed such a bowl may contain metals worth many thousands of pounds

all, for stars are great bodies like the sun, while "shooting stars," or meteors, are tiny bits of matter, usually smaller than a cricket-ball But they are travelling so fast—twenty-six miles a second on the average—that when they strike the earth's atmosphere they grow flaming hot, and are entirely consumed as a rule before they reach a distance of more than thirty miles from the ground There is little doubt that some meteors are particles of comets which have broken up

One proof of the connexion between comets and meteors is that swarms of meteors travel on orbits or paths which were once occupied by comets When the earth passes through one of these orbits we have meteoric "showers"

While meteors are individually very small, it is believed that their total mass may amount to 50,000 tons in a year Part of this is added to our atmosphere in the form of gases, and part of it is probably deposited on the earth in the form of ash or small particles

What Is a Meteorite?

Objects similar to meteors sometimes strike the earth These are known as meteorites or aerolites It is possible that they are meteors which are large enough to get through the atmosphere before being burned up, but the peculiar stone and iron formations which characterize meteorites suggest a different origin

Meteorites may weigh from a few pounds to many tons They are mostly of a stony character, though about one in every ten is composed principally of iron This iron is combined with nickel, cobalt, copper, etc, in a way different from any combination found on earth, and the crystallization is of a special kind

Armour plate was first made as a result of the knowledge gained through analysis of meteorite composition In cutting up iron meteorites it was found that those having 90 per cent of iron and about 10 per cent of nickel were very hard and extremely difficult to slice By mixing iron and nickel in the same proportions a steel was made which was harder and tougher than any known at that time

A meteorite weighing some seventy tons was found in Tanganyika in 1931, while near Winslow, in Arizona (U S A), is Meteor Crater, 570 feet deep, believed to have been caused by a huge meteor The largest meteor so far recorded, however, is the one that struck central Siberia in 1908, laying waste a large area of forest land—fortunately uninhabited This must have weighed about 40,000 tons

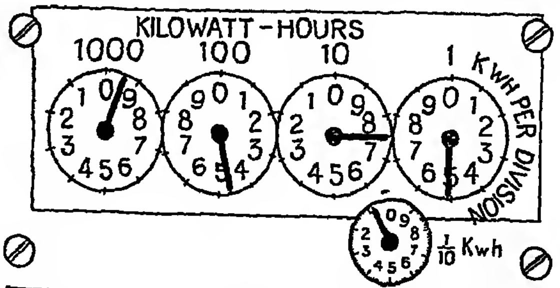
Many swarms of meteors seem to fall from a single point in the sky which is called the "radiant," and the various swarms or groups are named from the constellation in which the radiant appears to lie Thus we have the Leonids, Perseids, etc The Leonids are active in November, other groups appear in August, April, September, and October

Meters. In a cupboard or cellar of many houses—perhaps the one you live in—you sometimes find one if not two kinds of meters, which measure the quantities of gas and electricity used on the premises

The electric current used by a customer passes through the meter round coils of electric magnets, setting up a magnetic field of force These forces act upon a metal cylinder or disk that is free to rotate on a pivot turning a tiny shaft, just as the shaft of an electric motor is operated by similar magnetic forces The more current used the faster it turns, so the number of its revolutions indicated on the dials measures the amount of current passed through the meter The cylinder is pivoted on a sapphire or diamond jewel to reduce the friction as much as possible The rotating shaft of the cylinder operates the first disk, and the cog-wheels operating all the disks are geared together in such a way that a revolution of the first disk will move the second a fraction of the distance around its dial, and the second disk will move the third, and so on, the disks registering, in order, units, tens, hundreds, and thousands of kilowatt-hours

The gas meter has two gas-tight chambers, each having a leather bellows arrangement The disks of the bellows are connected in such a way that when one bellows expands the other contracts Gas for the burners is drawn first from inside one bellows, then the other The valves are so arranged that gas from the mains is supplied to the chamber surrounding the bellows which is being emptied The pressure in the chamber squeezes gas from the bellows which the chamber contains into the burners

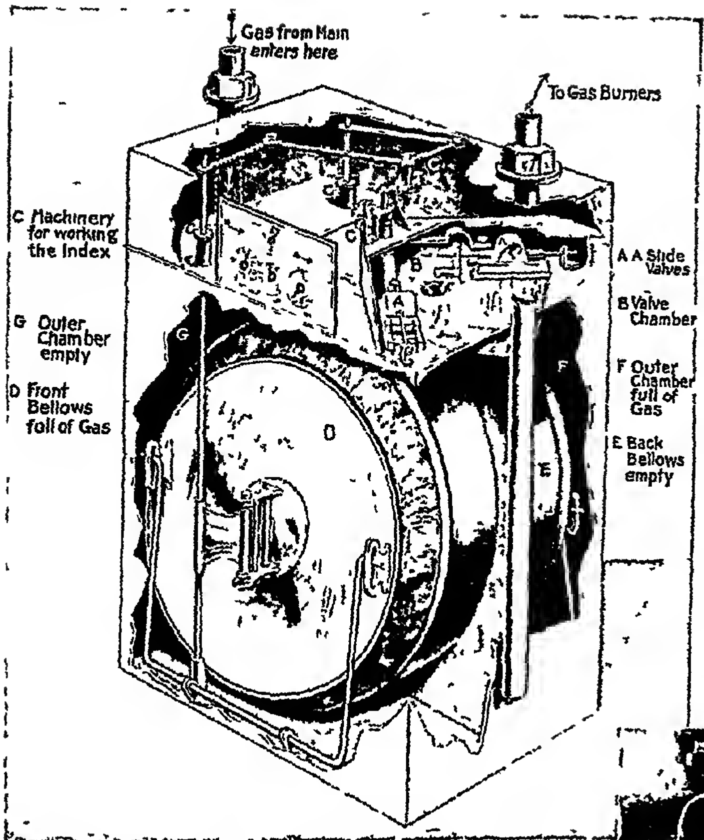
Meanwhile the other bellows is expanding This draws in gas from the surrounding chamber,



DATE	READINGS	UNITS USED
July 1st	8090	
Oct 1st	8724	634
Jan 2nd	9475	751

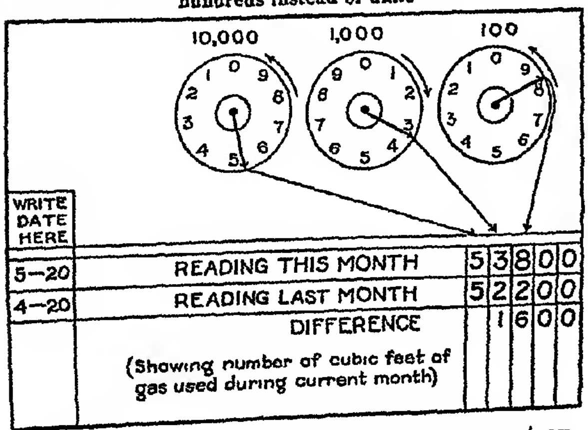
READING THE ELECTRICITY METER

To read your electricity meter, look at the first dial on the right. Set down the lower of the two figures between which the arrow is pointing (if between 9 and 0, read 9) Do the same for the other dials Subtract from this the reading on last quarter's bill and you have the number of kilowatt-hours or Board of Trade Units (B T U) you have used since Some modern meters read directly, like the mileage recorder on a car



THE 'INSIDES' OF A GAS METER

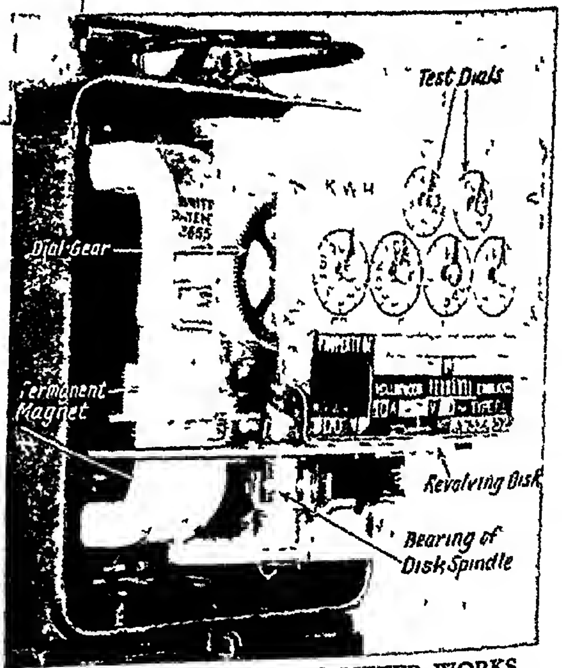
Gas first enters the triangular chamber (B), which is cut away to show the valves (A) The back valve (A) is open and admits gas to the back chamber (F) In this chamber is a bellows (E) with its interior connected through a valve to the pipe supplying the burners As soon as a burner is opened, releasing gas from inside the bellows, the pressure in the chamber (F) forces the diaphragm of the bellows inward As it moves in, it pushes out, by means of a connecting rod, the diaphragm of the front bellows (D), which now sucks in gas from the front chamber (G) This chamber, you must understand, has been filled by a previous stroke of the meter When the back bellows has been emptied in the manner described, the back valve in the triangular chamber (B) closes, and the front valve opens, admitting gas into the chamber (G) This forces the front bellows inward, and so the pumping goes on, like a mechanical heart The system of rods (C) records the movements of the bellows on the dials and tells you how much gas has passed through the meter The dials, shown below, are read like those of the electric meter described on the preceding page, except that the right-hand dial shows hundreds instead of units



which has been filled by the previous operation of the meter When one bellows is empty the valves shift and reverse operations The valves operate the small drive shaft to the cog-wheels of the dials, so that the number of revolutions indicates the number of times the measure of gas in the gas-chamber has been used by the customer, and the scale on the dial shows just how many cubic feet of gas have actually passed through

Metric System. The simplicity of the metric system, with its unit base of 10, renders it ideal for all purposes of calculation, and in addition to this advantage is the fact that measures of length, area, volume, and weight are strictly relative to the same base The fundamental metric unit of length is the *metre*, which is a little more than a yard (actually 39 37 inches) Dividing the metre by 10, 100, and 1,000 gives the smaller units, distinguished by the Latin prefixes, *deci*, *centi-*, and *milli-*, multiplying by the same numbers gives the larger units, distinguished by the Greek prefixes *deca-*, *hecto-*, and *kilo-*, as in this table

10 millimetres (mm)	=	1 centimetre (cm)
10 centimetres	=	1 decimetre (dm)
10 decimetres	=	1 metre (m)



HOW AN ELECTRICITY METER WORKS

Here you see the instrument which measures the electricity your lights use The current passes through electro-magnets causing rotation of the disk, the speed of which is controlled by the permanent magnet on the left The spindle of the disk turns the pointers on the dials

Ferranti Ltd

10 metres	=	1 decametre (dam)
10 decametres	=	1 hectometre (hm)
10 hectometres	=	1 kilometre (km)

The units most used in actual measurements of length are the *millimetre* (about $\frac{1}{25}$ inch), the *centimetre* (about $\frac{2}{5}$ inch), the *metre*, and the *kilometre* (about $\frac{5}{8}$ mile—3,280 feet, to be exact)

In surface measure the most common unit is the *hectare* (10,000 sq metres=2 471 acres)

A hollow cube measuring 10 *centimetres* on each edge would hold 1 *litre*, the basic unit of capacity in the metric system It is just about $1\frac{3}{4}$ pints It is divided and multiplied to make the smaller and larger units, respectively, viz

10 millilitres (ml)	=	1 centilitre (cl)
10 centilitres	=	1 decilitre (dl)
10 decilitres	=	1 litre (l)
10 litres	=	1 decalitre (dal)
10 decalitres	=	1 hectolitre (hl)
10 hectolitres	=	1 kilolitre (kl)

The cubic capacity of a *litre*, it will be seen, is 1,000 cubic centimetres The *litre* and the *hectolitre* are the units in this table chiefly employed Dry and liquid measures are identical in the metric system, but where the metric system is employed in commerce there is the same tendency to buy and sell by weight instead of dry measure

One *millilitre* of pure water weighs 1 *gram*, the basic metric unit of weight Multiplied and divided for larger and smaller units, it gives

10 milligrams (mg)	=	1 centigram (cg)
10 centigrams	=	1 decigram (dg)
10 decigrams	=	1 gram (g)
10 grams	=	1 decagram (dag)
10 decagrams	=	1 hectogram (hg)
10 hectograms	=	1 kilogram (kg)
10 kilograms	=	1 myriagram
10 myriagrams	=	1 quintal (q)
10 quintals	=	1 metric ton (t)

The *milligram* and *centigram* are chiefly used in exact scientific work The units most used in the ordinary transactions of life are the *gram*, a little more than $\frac{1}{30}$ ounce, the *kilogram*, about $2\frac{1}{5}$ pounds (2 2046 pounds avoirdupois), and the *quintal*, about 220 pounds

When the metric system was adopted by the French National Assembly in 1791, it was decided to take as the value of the metre the ten-millionth part of the distance on the earth's surface from the pole to the equator It was hoped thus to have a natural and invariable standard from which all the values of the metric system could be recovered if by accident the physical standard should be lost, but the original calculation was subject to a slight error

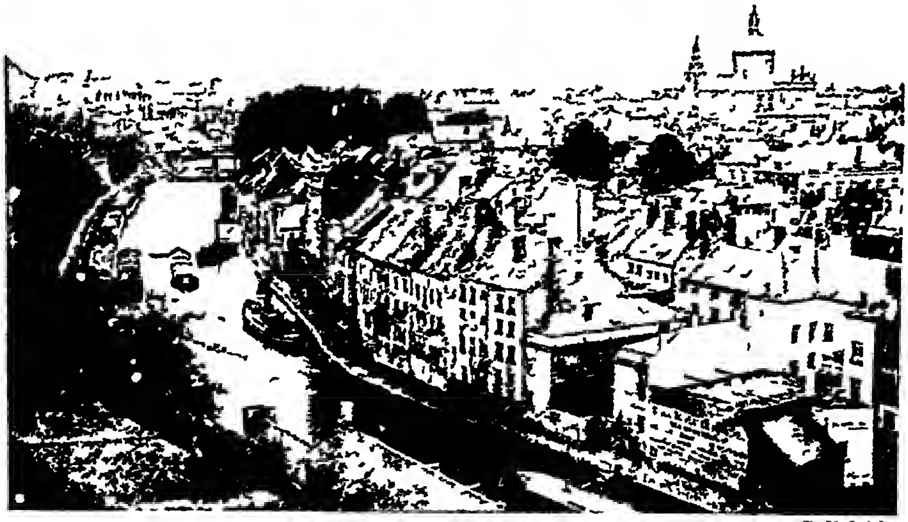
The international standard metre and kilogram are made of platinum-iridium and kept at the International Bureau of Weights and Measures near Paris (*See also* Weights and Measures) In 1897 Great Britain made permissible the use of the French or metric system in addition to the imperial standards of weights and measures The metric system is employed for all scientific work requiring exactitude and easy working

Metz, France On November 10, 1918, the armies in France were preparing a blow at the town of Metz, then in German Lorraine But the blow was never delivered, for the next day the Armistice put an end to the fighting Eight days later the French entered the town

Metz is situated on the river Moselle, and is a part of the "middle strip" which has been disputed between Germany and France almost since the days of Charlemagne It successfully resisted a great siege by the Emperor Charles V in 1552, and played an important part in the Napoleonic campaigns The second famous siege of Metz occurred when Marshal Bazaine of the French Army shut himself up in the town on August 19, 1870, and surrendered to the Germans on October 27 following At the close of the Franco-Prussian War the German General Moltke insisted that this fortress town, together with a great part of Lorraine and all Alsace, must be taken from France

Next to the tremendous system of fortifications developed by the Germans, the most interesting sights in Metz are its fine Gothic cathedral (begun in the 13th century) and traces of its ancient Roman aqueduct The population is about 83,000 (*See* Alsace-Lorraine)

Meuse, River This historic river of western Europe saw the first great struggle of the World War, when the invading Germans, in 1914, took Liege, on its eastern bank It likewise saw the last decisive effort of that conflict



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HISTORIC CITY ON THE BANKS OF THE MEUSE

On the banks of the river Meuse near its confluence with the Sambre stands Namur, one of the most famous cities of Belgium This photograph, which was taken from the hill on which stood the old citadel, shows a part of the city with old-time houses at the edge of the river Above the houses can be seen the 13th-century cathedral of St. Alban

when the French on November 11, 1918, advanced along its western bank, taking Sedan

Rising in north-eastern France, the Meuse flows north into Belgium, where it receives at Namur its chief tributary, the Sambre, almost doubling its volume It then flows north-east across Belgium, and enters Holland, where it is called the Maas, sweeping in a great curve round to the west, it joins the Waal, an arm of the Rhine, but divides again, the north branch entering the North Sea about twenty miles below Rotterdam, and the south branch passing through the two arms of the Hollandsche Diep

A most interesting feature of the Meuse is its disappearance beneath the ground for a distance of over three miles shortly before it enters Belgium The Meuse is, in effect, though not actually, a tributary of the Rhine The direct distance from its source to its mouth is only 230 miles, but because of its many windings it measures 560 miles in its course Its larger tributaries (besides the Sambre) are the Ourthe, which pours in its waters at Liége, and the Roer, which joins it in southern Holland

The commerce of the Meuse is probably only exceeded by that of the Rhine A series of canals in Belgium and in Holland makes it navigable for 360 miles, and another canal extending to the Saône has linked it with the great inland waterway system of France

REAL LIFE *in* ROMANTIC MEXICO

Most of us are familiar with the Mexican cowboy, with his flashing teeth, his ear-rings and sombrero, for we have seen him on the "pictures", but life in Mexico is not all romance and adventure

Extent—Greatest length (north-west to south-east), more than 1,900 miles, width, from 1,800 miles along the northern boundary to 134 miles at the Isthmus of Tehuantepec Area, 787,000 square miles (including island groups off the coast) Population about 16,553,000

Physical Features—Mountain ranges Eastern Sierra Madre and Western Sierra Madre (highest peaks, Orizaba, about 18,250 feet, and Popocatepetl, 17,782 feet), central plateau 6,000 to 9,500 feet high Principal rivers Rio Grande, Conchos, Sonora, and Yaqui

Chief Products—Petroleum, silver, gold, copper, lead, zinc, antimony, etc, maize, cotton, wheat, sisal, hemp, coffee, beans, sugar-cane, tobacco, fruit, live-stock, sugar and tobacco manufactures, textiles, spirits, and wine

Principal Cities—Mexico City (capital, population over 1,000,000), Guadalajara (184,000), Monterey (137,000), Puebla (122,000), Mérida (110,000)

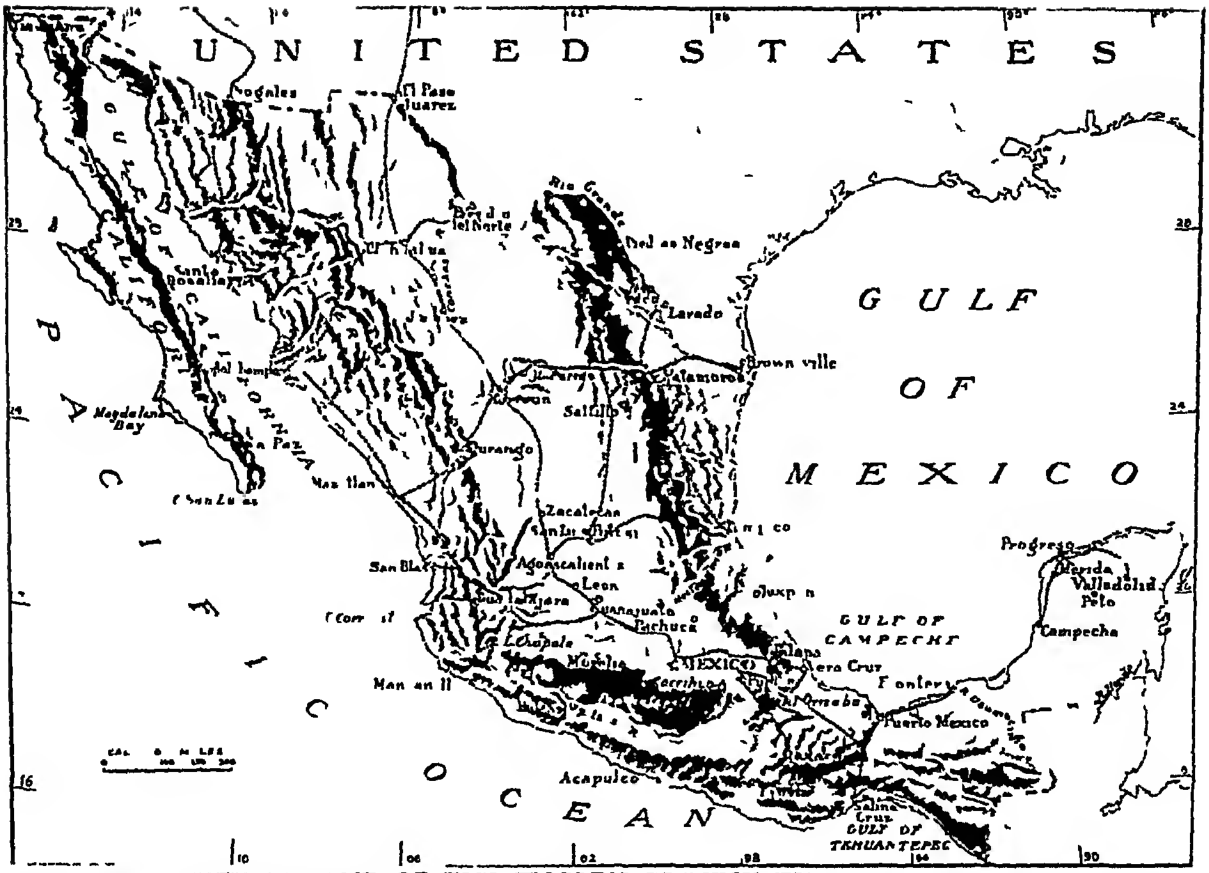
Mexico. Land of adventure and romance, of Cortes and the Aztecs, of silver mines and rolling plains, pieces of eight and stilettos, of caballeros and señoritas—such is Mexico, the great republic lying between the United States and the republics of Central America Veritably an empire in extent, Mexico has an area of 787,000 square miles, this area being greater than that of Great Britain, Germany, and France combined Its shape is, appropriately enough, much like that of a horn of plenty The coast-line extends a distance of 1,727 miles on the Gulf of Mexico, and for 4,574 miles on the Pacific

Majestic mountains, rising abruptly from the shores of the Atlantic, greet the eye of the traveller entering the magnificent harbour of Vera Cruz In general, however, the land surface rises gently from the east and west coasts and from the Rio Grande to the broad table-land of the interior, where most of the mining and the agriculture are carried on, and where most of the people live

There are no good natural harbours on the east coast, but great sums have been spent to make Tampico and Vera Cruz serve the needs of the country Progreso is the great sisal shipping port of Yucatan Excellent harbours abound on the west coast, however, among the more important being Mazatlan, Salina Cruz (the terminus of the railway across the Isthmus of Tehuantepec), Acapulco, Guaymas, and La Paz

The boundary between Mexico and the United States is 1,833 miles long, of which 1,136 miles are constituted by the Rio Grande South of the border are majestic mountain ranges, in the east and the west, known as the Sierra Madre Oriental and the Sierra Madre Occidental These mountain chains form a link of the great Cordilleran system, and contain some of the grandest scenery on the American continent Several of the highest peaks on the continent are found in Mexico, among them being the extinct volcanoes of Popocatepetl (17,782 ft), Orizaba (18,250 ft), and Ixtaccihuatl (16,960 ft)

The climate of Mexico varies widely with the elevation Hot weather prevails generally on the coasts As one penetrates farther into the interior, however, the weather becomes delightfully cool and bracing One finally reaches the region of perpetual spring at an elevation of 3,000 to 6,000 ft, a region where extremes of heat and cold are unknown So slight is the variation of temperature that wheat and sugar cane are grown side by side From an elevation of 6,000 ft upwards extend the *tierras frias*, or cold lands During the rainy season, from the middle of May to October, torrential storms drench the southern half of the republic, but the mountain ranges bordering the plateau prevent the moist winds from reaching the interior, so that nearly all the farming land requires irrigation



MEXICO, ONE OF THE WORLD'S RICHEST TREASURE LANDS

Mexico is a land of amazing contrasts. The country and its population suffer from bitter poverty in spite of the fact that its hills and plains contain a store of mineral wealth—gold, silver, iron, oil—which staggers the imagination. The mass of its people are constantly on the verge of starvation, although many spots in Mexico are veritable fairy gardens of productiveness. Desert, mountain, forest, sea-coast—one can find any climate and soil desired in Mexico, all awaiting the permanent establishment of peace and order in their development.

Most fruits flourish in Mexico, and nearly every variety of grain grows luxuriantly in the rich soil of that favoured land. Millions of acres are covered with trees whose woods are the most valuable in the world for industry.

The mountains of Mexico form one vast deposit of valuable minerals. Nearly all the famous mines of Mexico are situated on the south central plateau at an elevation of 5,500 to 9,500 ft. Silver is found in all the states, but more than half has come from Zacatecas, San Luis Potosi, and Guanajuato. The Veta Madre lode of Guanajuato, which is one of the richest veins ever discovered, produced silver to the value of £50,000,000 between 1556 and 1803, and is still being profitably worked. Enormous quantities of lead are found in Mexico, this metal occurring in association with the silver. Gold, copper, antimony, quicksilver, vanadium, bismuth, zinc, manganese, and graphite are among the other valuable mineral resources, and tin has been found at Chihuahua. Iron is abundant over a large area. Engineers estimate the amount of ore in sight on the famous Cerro del Mercado at 500,000,000 tons. So far, lack of fuel has made it impossible to dig it out.

The history of oil in Mexico makes a veritable romance. Although the presence of oil and asphalt in great quantities had been known for many years, attempts on the part of Mexicans to extract this wealth failed. In 1883 wells were sunk in Tabasco without result. Later a company, of which Cecil Rhodes was the guiding light, failed in a similar attempt. Repeated failures discouraged investors until 1901, when operations were begun at Ebano. The Americans then opened up the Casiano district and drilled the greatest oil-gushing well the world had ever seen, known as Casiano No. 7. More than 30,000,000 acres of oil-producing land are now devoted to the industry.

Cattle and Cotton in Mexico

Many other industries are profitably pursued in the country. Hundreds of thousands of acres on the northern plateaux are devoted to stock-raising. Cotton milling is a great industry in Mexico, and overshadows the woollen mills, since the native demand is chiefly for cotton garments. The numerous fibre plants support a considerable rope and cordage industry. There are many soap and cotton-seed oil factories, and petroleum-refining is one of the industries increasing steadily in importance.

The manufacture of iron and steel products, including rails and smaller agricultural implements, has also had a considerable growth,

centring at Monterey, in recent years Rubber is also manufactured where the guayule plant grows Mexican cigar and cigarette factories not only supply all local needs, but export manufactured tobacco and cigars to Europe and the United States There are also many flour mills and sugar mills, and the manufacture of native drinks forms a large adjunct to the country's internal commerce Oranges, bananas, guavas, avocado pears, and custard-apples are grown in abundance on Mexican plantations The most important Mexican plant, however, is the agave or maguey Fibres of the maguey are used to make paper and rope, and its huge leaves serve as thatch for native houses

The yield of maize, wheat, and other cereals in orderly times is large, but has been seriously interfered with by revolutions The Mexican bean is grown in every state of the republic, and with maize forms the staple diet of the people Timber production is increasing constantly, the forests containing many rare and valuable woods Mahogany and ebony come from Mexico Logwood and other valuable dyewoods are largely exported Huge quantities of henequen, or sisal hemp, are exported from Yucatan every year, this particular branch of commerce having made Yucatan one of the richest states in Mexico

The floating gardens, or "chinampas," of Xochimilco, ten miles from Mexico City, are a remarkable feature of this town, which existed long before Columbus discovered America The shallow lake of Xochimilco is nearly covered with these gardens, which are floating masses of water plants The plants support soil, and are attached to poplar stakes which take root, secure the island, and give it a hedge-like boundary Waterways between are kept open by dredging The gardens raise fruit and vegetables for the city

THINGS TO SEE IN MEXICO

The children in the geography class are always interested in Mount Popocatepetl It has such a funny name! This word means "Smoking Mountain," and the mountain still justifies its name by emitting sulphurous fumes from its snow-rimmed crater

For centuries Mexico has been the cradle of wars—wars of conquest, wars of defence, civil wars In prehistoric times one native race after another dominated the country When the Spaniards under Cortes (q v) invaded and conquered Mexico (1519-21) they found the Aztecs in

THE NATIONAL BEVERAGE OF THE MEXICANS

The national beverage of the Mexicans is pulque made from the juice of the agave which oozes out and collects in cuplike formations at the bases of the leaves The workman sucks it up into a gourd and then empties the juice into a vessel where it is allowed to ferment. Pulque shops, where this drink is sold are as common in Mexico as tea shops are in Britain

power, under Emperor Montezuma (*See* Aztecs) In 1810, after three centuries in which Spain ruthlessly exploited the country and ill-treated the natives, Miguel Hidalgo, a parish priest, led a revolt, but he was captured and shot in 1811 Others kept the flame of revolt alive

On May 19, 1822, a Spaniard named Augustin de Iturbide proclaimed himself Emperor of Mexico and independent of Spain He was dethroned the following year and later put to death Half a century of civil war and revolution followed For thirty years the dominant figure was General Antonio Lopez de Santa Anna, who was president when Texas revolted and again during the war with the U S A.

Texas won its independence from Mexico in 1835, but ten years later boundary disputes with the United States resulted in another war The rule of Santa Anna, who had recovered power, ended with his exile in 1855

When President Juarez announced a two-year suspension of payments on foreign loans in 1861, France, under the Emperor Napoleon III, attacked and overthrew the Mexican government In the course of the struggle the French suffered a severe defeat on May 5, 1862, whence comes the Mexican national holiday known as the Cinco de Mayo (5th of May) In 1863 France declared Mexico an empire with Maximilian I, an Austrian archduke, as Emperor The United States protested against this violation of the Monroe Doctrine, and at the close of the American Civil War France withdrew its troops

The leader of the Mexican patriots, Porfirio Diaz, then captured Mexico City, in 1867, and took Maximilian prisoner The latter was tried by court-martial, and shot In 1877 Diaz secured the presidency after overthrowing Juarez's successor The progress of Mexico between 1884 and 1911, while Diaz ruled as a benevolent dictator, was perhaps greater than the sum total of the progress achieved by Mexico in all the centuries of its previous history Between 1911 and 1934 there were no fewer than 17 presidents, but, in spite of almost constant civil war, a great deal of beneficial work has been done in developing the land Travel has increased greatly, and visitors are gaining a finer appreciation of the new-old country Archaeologists are finding relics of the advanced

Wide World Photos

MEXICAN CHILDREN IN THEIR SCHOOL GARDEN

Gardens for schools are found now all over the world, and here we have an illustration of one in Mexico, where they have been instituted to enable the youngsters to get well acquainted with their future occupation, which will probably be connected with agriculture Mexico is one of the countries where for some years "advanced" views in politics and economics have held sway, and these schools are largely due to the influence of Socialist theorists As you see, poultry-keeping is also taught, two of the boys in the foreground having their chickens with them

Mayan and Aztec civilizations that flourished centuries ago, and Mayan art and architecture are having an influence on modern work

Mexican art is enjoying a renaissance that is bringing recognition in foreign lands to such modern painters as Diego Rivera and José Clemente Orozco Mexican craftsmen in their rude huts are turning out pottery, woven goods, feather work, and leather work which show the artistic skill that is their racial heritage

Dorien Leigh

THE OLD SPANISH CATHEDRAL OF MEXICO CITY

In most of the principal cities of South America there are great Roman Catholic cathedrals, some of them dating back to the days of the Spanish Conquest in the 16th century One of the most remarkable of these is that of Mexico City, standing in the Plaza de la Constitution It was begun in 1573, and was built on the site of the Aztec war-god's temple destroyed by Cortes, the conqueror of Mexico, in 1521 The great church was not completed until 1730

Mexico is a federated republic The president is elected for six years The country is divided into 28 states, two territories and a federal district The prevailing religion of the country is the Roman Catholic

Mexico City, Mexico The picturesque capital of the Mexican Republic lies almost mid way between the east and west coasts, on the great central plateau of Mexico, about 7,400 ft above sea-level and 200 miles north-west of Vera Cruz To the south tower the rugged Ajusco Mountains, and to the south-east the giant snow clad Popocatepetl and Ixtaccihuatl peaks Lakes Chalco and Xochimilco are connected with the lower part of the city by a canal called "La Viga," completed in 1898

Mexico City is laid out with almost unbroken regularity On the western side are the better residential sections, and on the east lie the poorer districts The buildings are low because of the frequent earthquake shocks The commercial and political centre of the city is the Plaza Mayor Facing this are the Spanish Renaissance cathedral (16th century), the national palace, and the municipal palace North of the national palace is the national museum, which houses an almost priceless collection of Aztec antiquities Leading from the public gardens is the magnificent boulevard Paseo de la Reforma

Mexico City was founded about 1325 by the Aztecs, who built a village of mud and rush dwellings on little islets in Lake Texcoco and called it Mexitli, in honour of their god of war It grew rapidly, and in the 15th century the rude dwellings were replaced by stone structures The town had reached the height of its glory when, in 1519, the Spaniards under Cortes appeared, and practically destroyed it It was rebuilt by natives under the direction of the conqueror The city's population is over 1,029,000

Mica. A piece of this mineral an inch thick can be split into nearly a thousand sheets, each as thin as the thinnest tissue-paper For its familiar use in the doors of stoves and as chimneys for incandescent gas-burners, it is split into sheets about as thick as heavy paper These sheets are tough, elastic, and resistant to heat, and those made from the variety of mica called "muscovite" are almost as transparent as glass The name muscovite, or muscovy glass as it used to be called, came from the fact that this mica was used for windows in Russia

The chief use for mica today is as an insulator in electrical apparatus, since it is a poor conductor of electricity Broken into small sparkling bits it is also much used as "spangles" to produce glittering effects on stage costumes

All the varieties of mica are silicates of aluminium with other elements, that is, are compounds of silicon and aluminium with other

THE CREATION OF ADAM (above), in the Sistine Chapel of the Vatican The artist lay on his back to do these ceiling paintings, which represent the story of Genesis from the Creation to the Flood This ceiling, the most famous of all Michelangelo's paintings, cost him four and a half years of the most trying and difficult labour

THE DYING SLAVE (above), now in the Louvre, is one of three completed marbles intended for the monument of Pope Julius II

THE HOLY FAMILY (right), in the Uffizi at Florence One of his early works, this is the only known completed easel painting by Michelangelo left in the world today While more conventional than his later work, it manifests the same strength, and that power of showing much action in little space, which later made him known as "The Furious" There also exist a number of works designed and partly executed by him, of which the National Gallery in London has two

THREE MASTERPIECES WE OWE TO MICHELANGELO'S GENIUS

things in minor quantities Muscovite also contains potassium Most of the world's supply of sheet mica comes from India, but the United States and Canada furnish most of the "scrap" mica Mica is found in shades of yellow, green, brown, red, and black

Michelangelo Buonarroti. (Pron mi-kel-an'-je-lō) (1475–1564) On a scaffolding many dizzy feet above the floor of a chapel in Rome lay a man, painting with fast, furious master-strokes on the wet plaster of the ceiling which stretched its five thousand square feet of surface above him It was Michelangelo, the greatest genius of the Italian Renaissance, who between the years 1508 and 1512 decorated the ceiling of the Sistine Chapel, revealing there his immortal vision of the world's creation

Today we gaze in awe at the nine scenes depicting the story of Genesis from the Creation to the Flood, and we can understand why artists call this "the most extraordinary piece of technical work ever accomplished"

And not only are we thrilled by Michelangelo's lofty conception and by his masterly technique, but we are stirred, also, by his indomitable will and almost superhuman energy and courage to endure the "great hardships, illness, and overwhelming labour" that accompanied this work

Michelangelo was born March 6 1475, at Caprese, a small Tuscan town of which his father was governor The Buonarrotis were a poor but noble family of Florence He grew up in Florence, and soon began covering the walls of his home with charcoal drawings Nothing could cure him of his taste for art

At the age of thirteen he was apprenticed to Ghirlandaio, the painter, who showed him how to

copy drawings, mix colours, and lay the groundwork for frescoes. Then, a year later, he was admitted as one of the chosen pupils to the School of Sculpture which Lorenzo de' Medici, the great merchant prince and patron of art, had established in his palace gardens at Florence.

Here, amid a famous collection of old Greek and Roman sculpture, the boy began to work, showing such skill in copying the head of a laughing faun that Lorenzo took him to live in the palace. He worked here untiringly until he was 18. Then Lorenzo died, and two years later Michelangelo was in Rome, making great progress with sculpture, the art he loved best. The pietà, the statue of the Virgin Mary holding the crucified body of her son, was sculptured during his stay here, and its fame spread so rapidly that the young sculptor was recalled to the city of Florence.

There at the age of 26 he retired into a workshop built round an 18-ft marble block which another sculptor had half spoiled 40 years before. When he removed the covering two years later, the artistic world gasped, for out of that cramped colossal mass he had created his wonderful "David"—one of the world's greatest statues.

The year 1505 found Michelangelo again in Rome, this time to design a tomb for Pope Julius II. It was to be a magnificent three-storeyed tomb, representing art and victory, but political upheavals, countless jealousies, and changes of plan after the Pope's death interfered with the work. In the end Michelangelo completed only a few figures for the much reduced tomb. Among them were the majestic "Moses" (*see* illustrations in page 2295), which is part of the memorial as it appears today, and the "Slaves," now in the Louvre.

By common consent, these are among the supreme triumphs of the sculptor's art. With them rank the figures of Dawn and Dusk, Night and Day, and the portrait statues which Michelangelo did for the Medici monument.

More than 20 years after he did his ceiling frescoes for the Sistine Chapel, Michelangelo began to paint his enormous "Last Judgement," sixty feet in height, on the wall of the chapel behind the altar. In its vast proportions, technical excellence, and daring conception it is a fitting companion for the ceiling paintings. It has been called the most famous single picture in the world.

MICHELANGELO
This bronze head of Michelangelo was done in the artist's own studio. It suggests the immense strength, stern honesty, and tragic gloom which were his outstanding characteristics.
The Louvre; photo Giraudon

Besides these masterpieces, Michelangelo left the world many other significant works in both painting and sculpture. Nor did these twin arts absorb all his many-sided genius, for Michelangelo used his vast powers in many fields. When his beloved Florence was in danger, he superintended its fortification. He wrote a collection of impassioned sonnets which in their impetuosity and vigour remind us of his work in marble. And, finally, he left us the greatest architectural achievement of the Italian Renaissance, the great dome of St Peter's in Rome, designed during his last years.

"Death plucks me by the cloak," he cried when he was 89 years old, and the brush fell from his hand. He was buried in the church of Santa Croce, the Pantheon of Florence.

Honoured as "more than mortal, angel divine," Michelangelo outlived his illustrious contemporaries Raphael, Leonardo da Vinci, and Correggio. Except for Titian, he was the last great figure of Italy's golden age of art. A stern and lonely dreamer, in the loftiness of his inspiration and in the number and variety of his immortal works Michelangelo still stands unrivalled. He is typical of the universal genius which the Italian Renaissance produced beyond any other epoch in the world's history. (*See* Renaissance.) In him were summed up the vigour of mind and body, the restless energy, the boldness of spirit, the freedom of action and expression, the curious combination of worldliness and religious zeal, which marked that period.

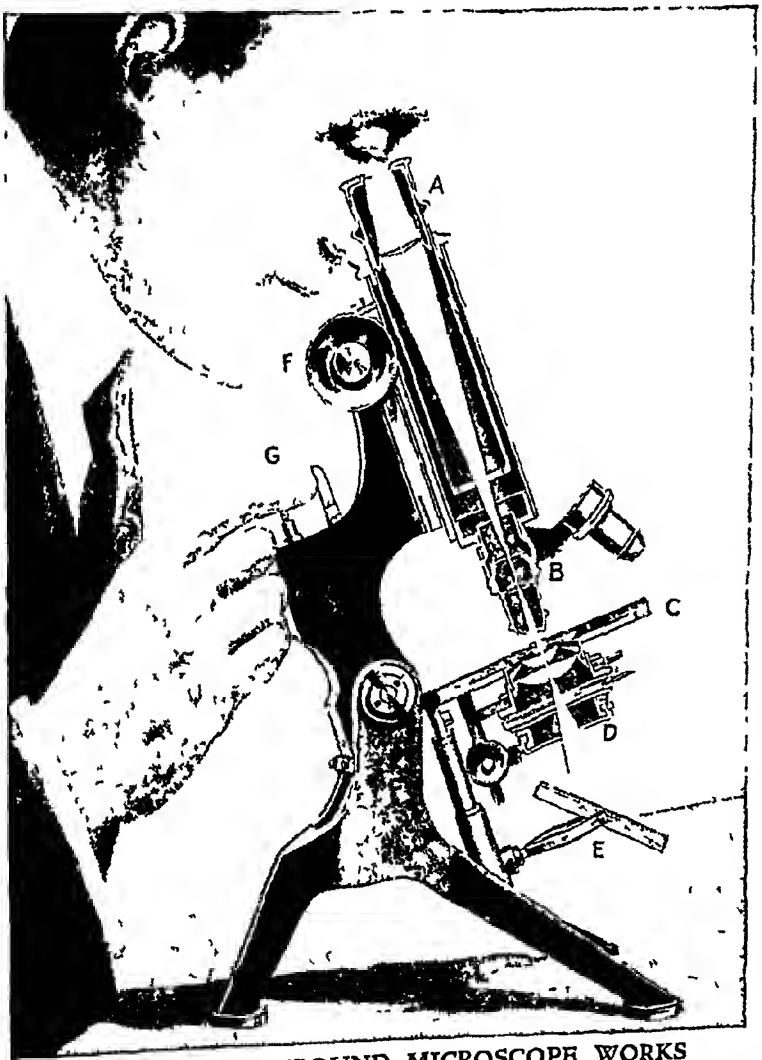
Michigan, U.S.A. This northern State borders on lakes Superior, Michigan (which lies wholly within the United States and divides Michigan State into two parts), Huron, and Erie. It covers 57,980 sq. miles, of which 500 are water. In the hilly northern peninsula copper, iron, and timber are produced in great quantity,

but in the south farming and manufacturing are the chief concerns, the city of Detroit (*q v*) being the centre of the national motor-car industry Other cities are Grand Rapids, Flint, Saginaw, and Lansing (population 78,000), the capital The population of the State is 4,842,000

Micrometer. A difference of $\frac{1}{1000}$ of an inch may not seem important, but some parts of a motor-car or a sewing-machine have to fit even closer than this In certain types of scientific apparatus, however, a discrepancy as great as this would render them useless To ensure perfectly fitting work, engineers employ devices called *micrometers* (from two Greek words meaning small and measure) The commonest type is operated by a screw having 40 threads to the inch Each turn of the screw, then, moves the measuring spindle $\frac{1}{40}$ or $\frac{25}{1000}$ of an inch A scale revolving with the screw is divided into 25 parts, and indicates, therefore, the fractions of a turn in units of $\frac{1}{1000}$ of an inch Sometimes such a micrometer carries in addition a "vernier" scale with which a movement of $\frac{1}{10\,000}$ of an inch can be read Micrometer readings are usually written as decimals, for example, the thickness of an ordinary sheet of newspaper is about 0035 in

Micrometer devices of even greater delicacy are frequently attached to microscopes and telescopes Some consist of simple scales ruled on glass with a fine-pointed diamond These rulings are themselves made by "dividing engines" regulated on the micrometer principle and capable of marking as many as 120,000 lines to the inch A common unit for such scales in scientific work is the *micron* ($\frac{1}{1000}$ of a millimetre or about $\frac{1}{25\,000}$ of an inch) The object to be measured is compared with this scale, both being equally enlarged Another device moves the image of the object across a hair-line in the eye-piece of the instrument, consisting of a spider's thread or a quartz fibre The distance moved is indicated by the turn of a micrometer screw

With the aid of micrometer controls, gauge blocks can be made that are accurate to $\frac{1}{1\,000\,000}$ of an inch at standard temperatures Such blocks have been used in adjusting instruments for measuring the velocity of light Similar blocks, though not necessarily so exact, are employed to check the accuracy of tools and dies in motor car and aeroplane factories



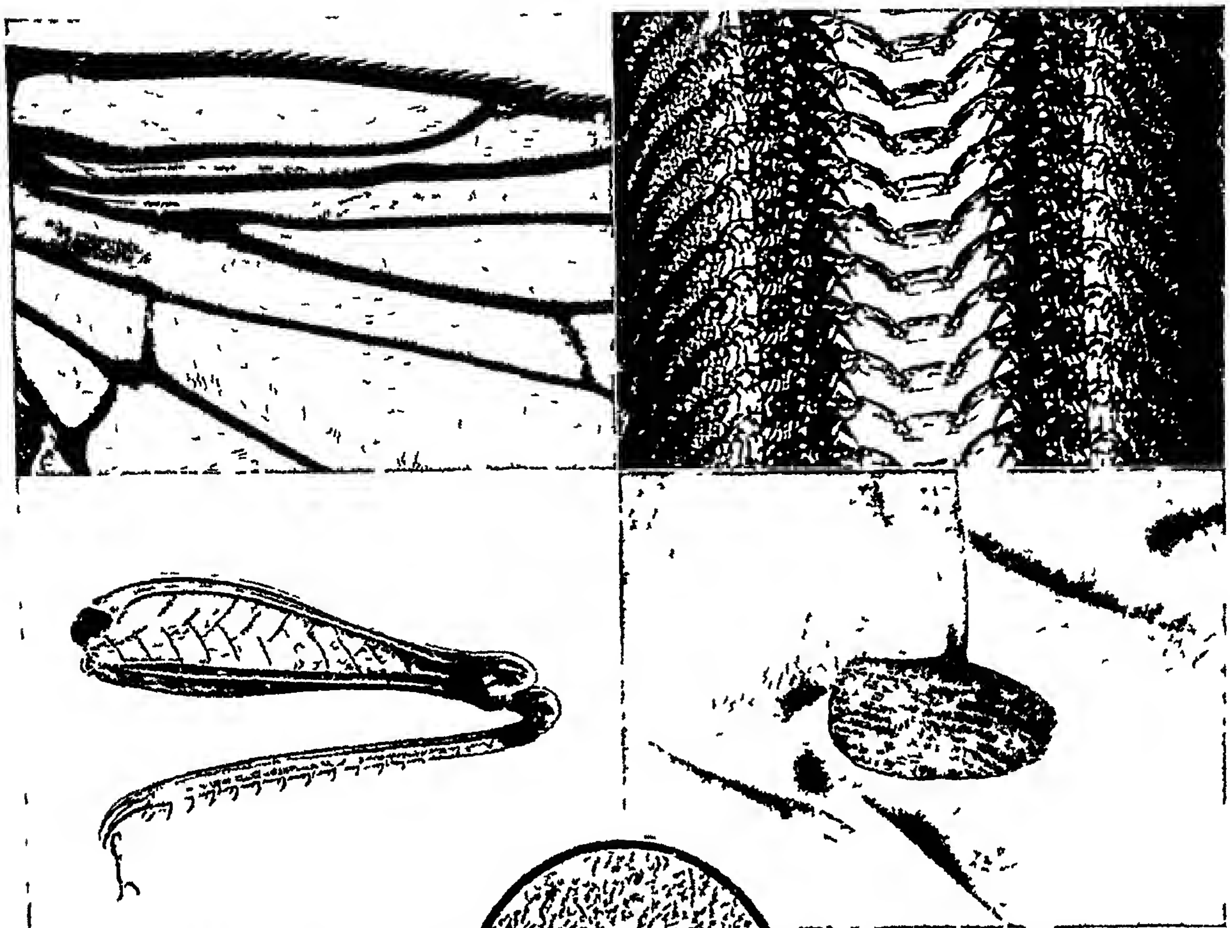
HOW THE COMPOUND MICROSCOPE WORKS

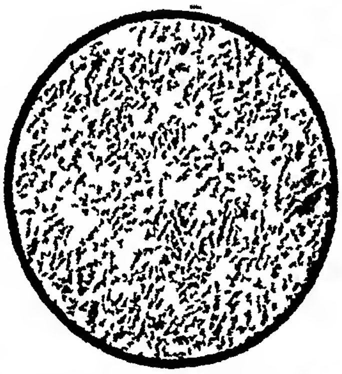
The object to be viewed is carried on a glass slide which rests over a small hole on the stage (C) Light from the mirror (E) is cast up through the condenser (D) and passes up through the hole on the stage, brightly illuminating the object to be examined The light from the object then enters the objective lens (B), where a reversed magnified image is then produced The eyepiece (A) enlarges this image further for the eye (F) and (G) are focusing screws

Microscope. The telescope adds a great deal to human knowledge, but in many ways the knowledge gained by the microscope affects our lives more directly Up-to-date physicians use the microscope to track diseases to their sources in various forms of bacteria, and the conquest of many diseases is due to the microscope

Surgeons determine by microscopic examination of a section of tissue whether severe operations for new growths in the body are necessary Botanists, biologists, and bacteriologists rely on it in their studies, which enlarge the bounds of knowledge and increase Man's mastery of Nature It is used to determine the structure of metals, and to detect adulteration in foods, drugs, etc

Ordinary magnifying glasses or simple microscopes—convex lenses used for obtaining a magnified





In the upper left-hand corner is a House-Fly s wing, so much enlarged that you can plainly see the ribs and the curious texture of the wing surface The right-hand picture shows a portion of the palate of the Abalone, a kind of shell fish With the help of the microscope its linked structure is plainly evident The lower left-hand corner shows the Grasshopper s hind leg, while the right hand picture shows the ' stridulating disk ' with which the insect known as Water Boatman produces its curious noise The circle shows a piece of paper, with the fine cellulose fibres appearing almost as coarse as hay

PHOTOGRAPHS MADE WITH THE MICROSCOPE'S AID

view of an object—were apparently known, at least as curiosities, from remote times, but the compound microscope was invented some time between 1590 and 1610 To Galileo, the famous astronomer, has been ascribed the honour of inventing first the telescope and then the microscope

Remarkable discoveries in anatomy and biology were made by the use of both forms in the 17th and 18th centuries For example, the Dutch scientist, Leeuwenhoek, sometimes known as the " father of microscopy," showed that weevils, fleas, and other minute creatures are not " spontaneously generated," but come from eggs, and the Italian, Malpighi, was the first to see the capillary circulation of the blood previously inferred by Harvey

A simple microscope may be a simple lens, or a set of lenses, if all are used together to view the object directly, it is a simple micro scope A compound microscope uses a lens called the object glass or objective to produce a reversed magnified image, and another, called the eye-piece or ocular, to magnify this image

Both objective and ocular, in actual practice, are composed of several lenses, because lenses are subject to the two defects of spherical and chromatic aberration Spherical aberration can be cured by grinding the lens in a parabolic curve, that is, making the lens a little thicker in the centre than if it were a slice off the outside of a sphere The practical difficulties of grinding true parabolic curves are so great, however, that spherical aberration is ingeniously corrected by compounding the lens

Chromatic aberration is corrected by using a convex crown-glass lens and a concave flint glass lens, and the curves of the two are designed to supplement each other so as to cure spherical aberration at the same time Often more than two lenses are used in the objective and in the eye-piece

The high-power compound microscope needs great skill in use The eye-piece tube is adjustable for different angles of observation and different distances from the objective It is provided with a micrometer to measure the

object, which is carried on an adjustable stage, or, if very high powers are required, placed in oil or water between the objective and a cover glass, and illuminated by light thrown from a mirror through a condenser A "camera lucida" attachment may be used to superimpose the magnified image on a sheet of paper, on which it may be traced

The power of such a microscope depends on the power of the object glass, the power of the eye-piece, and the separation of eye-piece and objective—the greater the separation the higher the power Powers of enlargement of more than 2,000 diameters are attainable for visual use, and photographs of very minute objects enlarged 5,000 diameters have frequently been produced

When the working of the instrument has been thoroughly mastered it is best to try the microscope for the first time on an object which does not need a very great deal of preparation The leg of an insect placed in a small drop of water on the slide and examined with plenty of light makes an extremely interesting subject, and the beginner will be astonished at the great pincers, the thick joints and the numerous hairs, with which it is provided

Is there any limit to the powers of the microscope? Can we not obtain ever greater and greater magnification, so that at last we can peer into those minute particles—molecules, atoms, and electrons?

There are certain practical difficulties, the chief of which is not the imperfection of the instrument but the very nature of light and vision We see non-luminous objects by the light which they reflect, and light is composed of waves An object much smaller than the wave-length of light cannot reflect light, any more than a pebble can break an ocean wave

Now, atoms and even the largest molecules are far below the size of light waves, and as for electrons, they are almost unimaginably smaller The wave-length of light also puts a limit to the magnification of telescopic images by the eye-piece Yet a way has been found to show, under certain definite conditions, not, indeed, the shape and size of ultra-microscopic particles, but their existence, number, and movements An object too small to *reflect* light *diffracts* it—scatters it all around—and may be seen against a dark background as a bright point, or, rather, an almost infinitesimal disk—tiny, indeed, yet far larger than its real size

An "ultra-microscope," so called, is a microscope fitted with attachments to show ultra-microscopical particles viewed across a shallow beam of intense light against the darkest possible background, as dust particles are seen dancing in a sunbeam traversing a dark room These movements are called the "Brownian movements" A powerful microscope of the ordinary type will show objects a few microns in diameter (a micron is about $\frac{1}{25000}$ of an inch), with the ultra-microscope objects measured in *thousandths* of microns may be perceived Though this is still coarse work so far as solving the mystery of matter is concerned, the ultra microscope is, nevertheless, an instrument that serves a most useful purpose

A long-range microscope has been invented for viewing the actions of small insects, and moving pictures of such small creatures have been shown

THE SECRET OF KING MIDAS

Here an artist has depicted the scene when King Midas removed his cap and his barber saw the ass's ears which Apollo had inflicted on him Midas is making the barber promise to keep his secret

Midas. According to mythology, Midas, a king of ancient Phrygia, in reward for a kind act was promised by the god Dionysus whatever he should ask Midas asked that everything he touched might turn to gold When the request was granted, he found to his sorrow that there are many things more necessary, for even his food became gold, and he begged the god to take back the gift

According to another story, told by Ovid, Midas once decided a musical contest between Pan and Apollo, giving the prize to Pan Apollo in revenge gave Midas a pair of ass's ears King Midas hid his ass's ears under a cap, but his barber discovered the secret and was so excited by it that he dug a hole in the ground and whispered into it "King Midas has ass's ears" A reed is said to have grown from this hole, and its whisperings spread the secret of the King's misfortune

From DARKNESS *to* DAWN *in* EUROPE

When Roman civilization crashed before the onset of the Barbarians, there followed a thousand years of slow rebuilding until the modern age dawned with the Renaissance. The story of that thousand years is reviewed here

Middle Ages. History is continuous like a stream, and just as a stream has rapids and waterfalls, so too has the great stream of human life. One great waterfall, so to speak, in the stream of European history was in the 4th and 5th centuries, when the Roman Empire crumbled and fell, after that until the 15th century the stream flowed on with no strikingly abrupt changes. The years between those centuries are known as the Middle Ages, although, in fact, they were no more "middle ages" than any other historical period. The term "middle ages" was applied to them some 300 years ago, and has clung to them ever since. The name is somewhat misleading, for it suggests that these years were peculiarly uneventful, whereas the truth is, as careful students of history have found, they were years of great significance for the development of many important features of our present day social and political arrangements. No one can understand some of our existing institutions without understanding something of the life and institutions of the Middle Ages.

If we go back in imagination along the stream of history till we come to the 4th century, we shall find the Roman imperial government holding sway over the entire Mediterranean basin, and over some regions beyond it. The Romans had conquered the Greeks, the Gauls, the Carthaginians, the Egyptians, and various other peoples. Roman civilization was made up of many mingled elements held together by the army, the roads, the trade, the law, and the government of the empire. (*See* Roman History)

A number of religions flourished in the empire, for the government, when it conquered a city or a region, allowed the people to keep their own religion and merely required them to give homage to the emperor. In a remote province there grew out of the religion of the Jews the Christian faith. The Christians believed that homage to

RETURNING FROM CHURCH IN MEDIEVAL TIMES

If there was one feature which marked the life of the centuries grouped as the Middle Ages, it was the love of pageantry and display. Ceremonial observance of rank and power accompanied the commonest actions of daily life no less than the affairs of State. This painting serves to illustrate the display made by high born ladies in attending church

From the painting by G H Boughton Guildhall Art Gallery

the emperor was idolatry, and that other religions were false and should be destroyed In the resulting struggle the Christians were prosecuted as enemies of the government, but their courage and zeal and thorough organization prevailed In the early 4th century the great emperor Constantine (ruled 306–337) sought their aid against his enemies, and in return made Christianity the official religion By the end of the 4th century the emperor Theodosius (ruled 379–395) had outlawed all other religions (*See* Christian Church)

Crumbling of the Roman Empire

At this time, on the borders of the empire, hordes of barbarians threatened both the Church and the government On the north were many tribes of Teutons, so barbarous, as Tacitus wrote about A D 100, that they had no word for autumn or harvest This shows that they were still merely hunters and fishermen, and had not advanced to the agricultural stage of civilization However, they were bold and warlike and were learning of the wealth in sunny Mediterranean countries and of the weakness of the Roman armies To the north-east of the Black Sea and the Caspian, on the world's greatest plain, tribes of fierce nomads wandered with their flocks and herds Among these were the Huns, who were of the Mongolian type, small in stature, with yellowish dull skin, dark straight hair, and slanting eyes Moving westward between the Ural Mountains and the Caspian Sea, they met the Goths, who were Germans Some of the Goths, fleeing before the Huns, crossed the river Danube in 375 and settled in the empire Soon they quarrelled with the Romans, and in the battle of Adrianople, in 378, decisively defeated the emperor's legions These events were followed by a " wandering of the peoples " Not only Huns and Goths, but also Vandals, Burgundians, Lombards, Franks, Angles, Saxons, and various other tribes wandered at will over the empire, pillaging, fighting, sacking Rome, and hastening the break-down of the empire " The whole world," wrote St Jerome, " is sinking into ruin "

The Roman world, indeed, was sinking into ruin , yet, in the midst of these troublous times, several forces kept society from falling into complete disorder One of these was the Byzantine Empire, the eastern or Greek portion of the Roman Empire It survived the barbarian invasions , and the armies of the mighty emperor Justinian (ruled 527–565) even for a time reclaimed Italy and northern Africa from the invaders In Constantinople art and industry flourished Justinian's architects built one of the world's finest structures—the cathedral of St Sophia His lawyers collected, edited, and reduced to a code the great system of Roman law Throughout the Middle Ages the Italians carried on extensive trade with the Byzantines and brought back to the West much of the culture of antiquity and of the East (*See* Byzantine Empire)

Among the barbarous tribes that invaded the empire in the West, the Franks differed in simply expanding from their Rhineland home as a base, and thus retained strength and stability Most of the other tribes, instead of expanding, migrated The Vandals, for instance, moved all the way from north central Europe to Africa, where they built up a short-lived kingdom The great kings of the Franks included Clovis in the late 5th century, Charles Martel, conqueror of the Mahomedans at Tours, in 732, and Charlemagne, who in 800 was crowned emperor of the Holy Roman Empire by Pope Leo III These powerful rulers, although often brutal, helped to rescue the age from lawlessness and disorder Important invasions, in addition to those of the Franks, were made by the Angles and the Saxons, Germanic tribes that began to settle in England at the opening of the 5th century They established several kingdoms, out of which grew the system of shires or counties Basic elements of English, German and French civilizations are traceable, respectively, to the Anglo-Saxons, the East Franks, and the West Franks

When Clovis was converted to Christianity, in 496, many of the Germans were heretics, and some were still pagans Clovis and his successors allied themselves with the bishop of Rome or the Pope , and the peoples they conquered obeyed the Roman bishop as head of the Church

In these years of invasion and uncertainty the monasteries did much to preserve knowledge of the arts, crafts, industries, and literature of Roman times They were also important in providing a discipline and a bond of union which helped to hold society together in an age when it was threatened with destruction or with reversion to savagery (*See* Monks and Monasticism)

Charlemagne's Empire Comes to an End

The great emperor Charlemagne became an ally of the Pope, and they subjected the barbarous invaders to a civilizing discipline However, even during the reign of Charlemagne, his dominions, which included nearly all of central and western Europe, were endangered by new invasions From the south-east came the Arabs from the Great Plain of Asia, the Avars the Bulgars, and the Hungarians , from north eastern Europe, the Slavs , and from the Scandinavian peninsula, the Northmen or Vikings Charlemagne's empire soon fell apart, and in its place there grew up a large number of feudal states The feudal lords acquired power as organizers of defence against the invaders (*See* the article on the Feudal System)

LAVISH HOSPITALITY IN THE MIDDLE AGES

Towards the end of the 15th century the rich nobility of Europe dispensed hospitality on a grand scale in their great houses This picture, reproduced from a French manuscript of about 1460, shows a noble host sitting under a canopy in his banqueting hall His steward with his wand of office stands at his right hand, and on the other side of the table is his carver with a towel flung over his shoulder Despite all this magnificence, fingers were used instead of forks

From Les très riches heures du Duc de Berry Musée Condé Chantilly photo Giraudon

Germans and the Italians from uniting under strong central governments, in France and England the kings were gradually extending their powers on a firm basis In each country the king had a feudal council consisting of his vassals At first, all government was carried on by the king and his council When public business became more complicated, various institutions grew out of the council Many of these still exist

Why, for example, does the British Parliament consist of two houses? This system dates from the Middle Ages The nobles were members of the king's council because they were his vassals In the 13th century, when the kings decided to call on the wealthy townsmen and the lesser landlords for money, they began the custom of sending out orders (writs) to the sheriffs of the counties, calling on the wealthy middle classes (commoners) to elect representatives to sit with the nobles in the council They preferred, however, to sit separately, and so the House of Commons was formed

Many other modern institutions and practices are fully as old Among these are counties and county courts, towns or parishes, and constables, writs, juries, circuit judges Then, too, our system of law and of procedure in the courts goes back as far as the 12th century

This brief story of the Middle Ages has been confined to the framework of society, and especially the great institutions of government and religion This framework was built up as a defence against the invasions and other dangers of the period, and was adapted to a simple, self-sustaining farm life

In the 12th and 13th centuries, when a greater measure of peace and order had been established,

In the eastern portion of the empire of Charlemagne there were several very powerful feudal lords Henry the Fowler and his son, Otto I, drove out the Hungarians, repelled the Northmen, built towns, called "burgs," which at first were little more than fortresses, and subdued their unruly nobles and bishops Many people still longed for a great empire, such as that of the ancient Romans These ideas found expression in 962 in the crowning of Otto I at Rome as emperor of the Holy Roman Empire (*q v*) The emperor was regarded as the ally of the Pope and the protector of the Church But emperors and Popes soon came to blows in a struggle called the "Investiture Conflict"

While the Popes and the emperors in Italy and Germany were wasting their energies in fighting each other and preventing both the

the age of rapid change in the political, social, and intellectual life of Europe began. It was the age of the great struggle for power between the Papacy and the empire, and it was the age of the Crusades, when hordes of Christians, fired by zeal to rescue the Holy Land from the Mahomedans, were travelling to and from the East, bringing new ideas, new customs, and new products to Europe. These centuries saw the rise of commerce and of the towns, which spelt the doom of feudalism and the beginnings of monarchical states. They saw the rise and development of universities and scholastic philosophy, and an intellectual and artistic awakening that was to flower in the centuries that followed. Later, the horizon of Europeans expanded to include even the Far East—India and China and the Spice Islands. Out of all these new influences came the Renaissance and the dawn of modern history.

Middlesex. This was always one of the smallest counties in England, and now that the whole of it is included in Greater London, there is very little of Middlesex that has not more or less lost its identity in the great metropolis. Even Brentford (*q v*), the county town of Middlesex, is only ten miles west of central London. In Saxon times there was a "great forest of Middlesex" in the north of the county, and even now there are, especially in the western division along the Thames, very extensive market-gardens and orchards, although these have been greatly encroached upon during the past fifty years by the huge growth of London. The county, covering an area of 233 square miles, is flat, with the exception of the "northern heights" of Highgate and Harrow-on-the-Hill, the seat of the famous public school. Beyond the outer suburbs of London there are still parts of Middlesex which retain their rural character.

Other towns in the county include Acton; Ealing; Enfield, where is the chief small-arms factory; Hendon and Heston, noted respectively for R A F and commercial aerodromes; Staines, where the Colne flows into the Thames; Twickenham, headquarters of Rugby football, and a borough which now includes Hampton with its magnificent palace—a royal residence for over 200 years—and Teddington, home of the National Physical Laboratory; Wembley, where the great British Empire Exhibition of 1924–25 was held, recalled today by the vast stadium where the F A Cup Final and other sporting events are held; and Willesden.

Great factories now line the Great West Road, the principal artery from London to the west. An ancient and still important highway is Watling Street, leading to the north-west. The population of Middlesex is about 1,638,000.

MIDDLESEX GUILDHALL IN LONDON

Though the county town of Middlesex is the old town of Brentford on the western borders of London, most of the county business is transacted at the Middlesex Guildhall, in Broad Sanctuary near Westminster Abbey. It is a fine Renaissance building, completed in 1913. The statue in front is of Abraham Lincoln, (see page 2504)

Midnight Sun. One of the most wonderful of natural phenomena is seen at the Arctic and Antarctic Circles on their respective Midsummer Days (June 21 and December 21). The sun does not set at all on this day, but sinks only to the horizon, and the sky is suffused throughout the night with an eerie glow.

Within the Polar regions the Midnight Sun continues for several days or even months. At North Cape in Norway (a country known as the "Land of the Midnight Sun") the sun is visible at midnight from May 12 to June 29. By contrast, the sun does not rise above the horizon at this point during two whole months of the winter.

'Midsummer Night's Dream.' According to the plot of this fanciful comedy, written by Shakespeare, the King of the Fairies, Oberon, and Puck or Robin Goodfellow, his elfin lieutenant, set out to bewitch Titania, Oberon's fairy queen. Discovering two pairs of lovers wandering in the Athenian wood, they include them also in their enchantments, as well as a company of workmen who have come into the wood to rehearse a rustic play with which to win the favour of the Duke of Athens on his wedding-day.

Queen Titania awakes from sleep to be absurdly in love, under the enchantment, with

H J Shepstone

WHEN THE SUN SHINES AT MIDNIGHT

IN this photograph there are not really seven suns though it looks like it, but the same photographic plate was exposed seven times during the "night" of June 21 the time when the sun never sets on the Arctic Circle Its nearest approach to setting is the slight declination seen in the middle of this string of suns then on the right, it begins to rise again This strange phenomenon of the Midnight Sun might be seen at any point on the Arctic Circle, and northern Norway is a favourite spot from which to view it This photograph, however, was taken in North Greenland, and the exposures were made at half hour intervals Like the seasons of the year, the Midnight Sun is due to the tilting of the Earth's axis The same sight is visible at the "other end" of the Earth for the Midnight Sun is seen on the Antarctic Circle at the summer solstice in the Southern Hemisphere December 21

L N A

WHERE THE SUN SHINES ALL NIGHT AT MIDSUMMER

The midnight sun is a phenomenon to be seen only in extreme north and south latitudes. It may be witnessed at any point on the Arctic Circle on our Midsummer Day, June 21, or on the Antarctic Circle on the Southern Midsummer Day, December 21. Within these circles the length of time the sun is in the sky day and night increases according to the latitude. In latitude 70°, for instance, the duration of the midnight sun is 65 days, and in latitude 80° it is 134 days. At the poles the sun does not set for six months. At midnight, however, it is not high above the horizon, and all the beautiful colours of an ordinary sunset are seen, as this photo taken in Norway shows.

To face page 2733

'A MIDSUMMER NIGHT'S DREAM' IN REGENT'S PARK

The Open Air Theatre in Regent's Park, London, provides an ideal setting for Shakespeare's 'Midsummer Night's Dream,' which has always been one of the most popular of his plays. Here you see Bottom with Titania, the fairy queen, and her retinue, the natural surroundings adding considerably to the effectiveness of the scene

"bully Bottom, the weaver," the chief of the clownish actors, on whom the mischievous Puck has placed an ass's head. In a highly comic scene her attendant fairies scratch Bottom's donkey-head and minister to his creature comforts, while their fond mistress kisses the "fair large ears" of her "sweet love."

The wandering lovers wake to find their loves reversed, and charming Hermia is about to scratch out fair Helena's eyes.

Puck, being a mischievous sprite, watches this sport in glee, but Oberon soon takes pity on them all, releases Titania from her foolish fancy, gives Bottom back his own foolish head, and the lovers their proper loves.

Then at daybreak all the human folk hasten back to Athens, the lovers to be wed, and Bottom and his friends to present their play—the oft told story of Pyramus and Thisbe, two lovers who, kept apart by their parents, yet conversed through an opening in the wall that separated their houses. One night they planned a secret meeting. Thisbe, startled by the roar of a lion, ran away, dropping her veil. When Pyramus arrived and found the veil torn by the lion's blood stained jaws, he imagined Thisbe had been slain and stabbed himself. Thisbe, returning, found the body of her lover and ended her life with the same weapon. As presented by the rustics, the tragedy becomes a laughable burlesque. After this "tragical mirth" the court retires to bed, and the play ends with the entry of the fairies to bless the house.

Mendelssohn (*q v*) wrote some beautiful, really fairy-like, music to preface and accompany the "Midsummer Night's Dream."

Mignonette. (Pron min-yon-et') The French have given this delicately fragrant flower, *Reseda odorata*, the name of mignonette, which means "little darling." In Africa and Asia Minor the mignonette is a plentiful weed, and it has become a garden favourite in England and the other countries to which it has been introduced.

Find a spot where the soil is rather light, sow your seed at intervals from March onwards, and you will have a continuous supply of these fragrant spiky flowers.

Migration, ANIMAL. The migration of birds and other animals is one of the most wonderful things in Nature. You know it chiefly as the migration of birds, bringing you some species in winter, others in summer; it brings the swallows and cuckoos in spring, and sends them back to the south in autumn.

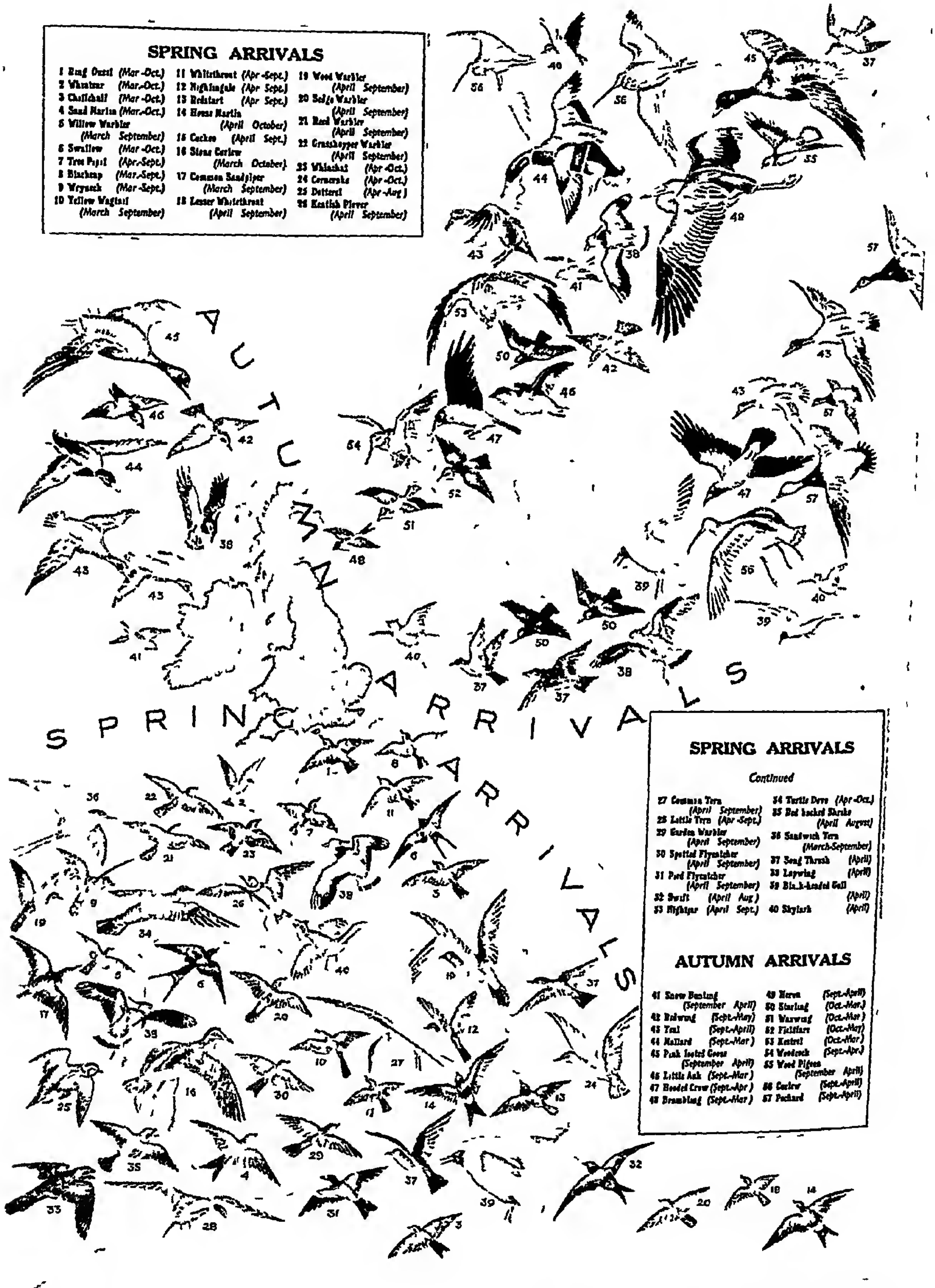
But all creatures, in one way or another, migrate. Insects—many kinds of butterflies, for example—migrate across the Channel, and go to warmer climes in winter; salmon migrate from the sea to the headwaters of certain rivers to lay their eggs; eels spawn in the sea and only their young return to the rivers as "elvers"; and red deer descend from the hills to the shelter of the woods in winter.

But where in all the Book of Nature will you find anything to compare with the journey of the Arctic terns, some of which nest within the Arctic Circle, and all of which winter on the islands of the Antarctic Ocean? Their summer and winter homes are separated by 10,000 miles of ocean, over which they migrate with the unerring flight of a homing pigeon that has been taken but a few miles from its loft.

Not all birds migrate in this sense of the word, but almost all make some regular seasonal movements from one place to another. Thus, woodland birds leave their thickets and come to the garden for titbits; moorland species like the curlew descend from the bleak hill-sides to feed in the estuaries and the salt marshes.

Most of the long migrations are performed by night, and on cloudy nights, when the birds are passing low to escape flying in the clouds, one often hears them as they call to one another

HOW SPRING & AUTUMN MIGRANTS REACH BRITAIN



In this specially-prepared picture are shown the more common birds which reach the shores of Britain as migrants in spring and autumn, together with the routes by which they come. Some of the migrants are included in both groups, for when our breeding birds go south for the winter, others of the same species often take their place in Britain. There are, too, many 'passage migrants'—birds which pass over Britain on their way south in autumn, and again on their return in the spring. Still other birds migrate from north to south within our own shores as the seasons change.

MIGRATING LEMMINGS STOP FOR NOTHING

One of the curiosities of nature is the way in which the Lemmings move in great swarms over Scandinavia When they decide to migrate they start across country ravaging crops on the way, swimming streams and climbing walls They continue in their headlong course until they reach the sea, and even there they do not stop but plunge in and perish.

The distance travelled in any one night or on any one continuous flight is ordinarily not more than 200 or 300 miles, but certain birds are known to travel enormous distances, apparently without stopping The American golden plovers appear to migrate from Alaska to the Hawaiian Islands, a distance of 2,000 miles, with no stopping-place between

Perhaps even more remarkable than the distances travelled by these birds is the fact that they are able to find their way over the trackless expanse of the sea without landmarks to guide them An instinct for home, preferably the place of their own birth, is apparently the cause of their return year after year to the same region for nesting purposes, but just *how* the bird finds its way is still a mystery

Many theories have been advanced as to why birds migrate, but this, also, is an unsolved problem It is, however, certain that they do so just as they sing or build their nests, because they cannot help themselves Many ornithologists think that migration may have originated in the desire, common to all organisms, to perpetuate their kind, to increase up to the full limit of the food supply, and to occupy all available territory

Higher animals also afford many interesting examples of seasonal migration Deer, goats, sheep, antelopes, and the like, in many parts of the world, regularly leave the plains for the mountains in early summer to escape the flies and to find new grass and safer solitudes In winter they seek the valleys and plains again

Many fishes and reptiles also perform long and complex wanderings, usually of the seasonal sort In the spring there are great migrations of herring, salmon, shad, trout, mackerel, and other fishes from deep water to shallow, so that their spawn may be hatched in places suited to the needs of their young (*See* also Eel)

Migration, Human Mass movements in the animal world have their counterparts in the migrations of peoples that have repeatedly changed the course of history

Migration sometimes occurs in great surges, sometimes in a slow, thin stream It may take place within the boundaries of a country, or it may extend into distant countries The impetus most frequently comes from over-population Migrations may also be necessitated by destructive climatic or geographical changes The advancing ice-cap over northern Europe in glacial times drove Man southward Again, the attraction of another place may be so strong that people are lured to it Such a motive started the gold rush to the Yukon Finally, a desire to gain political or religious freedom has inaugurated migrations

The wanderings of prehistoric Man gradually took him from his place of origin, which was probably in central Asia, to nearly all parts of the world except the Americas The Stone Age culture spread into western Europe, first around the Mediterranean and up the Atlantic coast, then inland by means of the river valleys Long residence in diverse and widely-separated regions brought about variations in physical characteristics, and Man became differentiated into races

Migrants from Asia's Heart

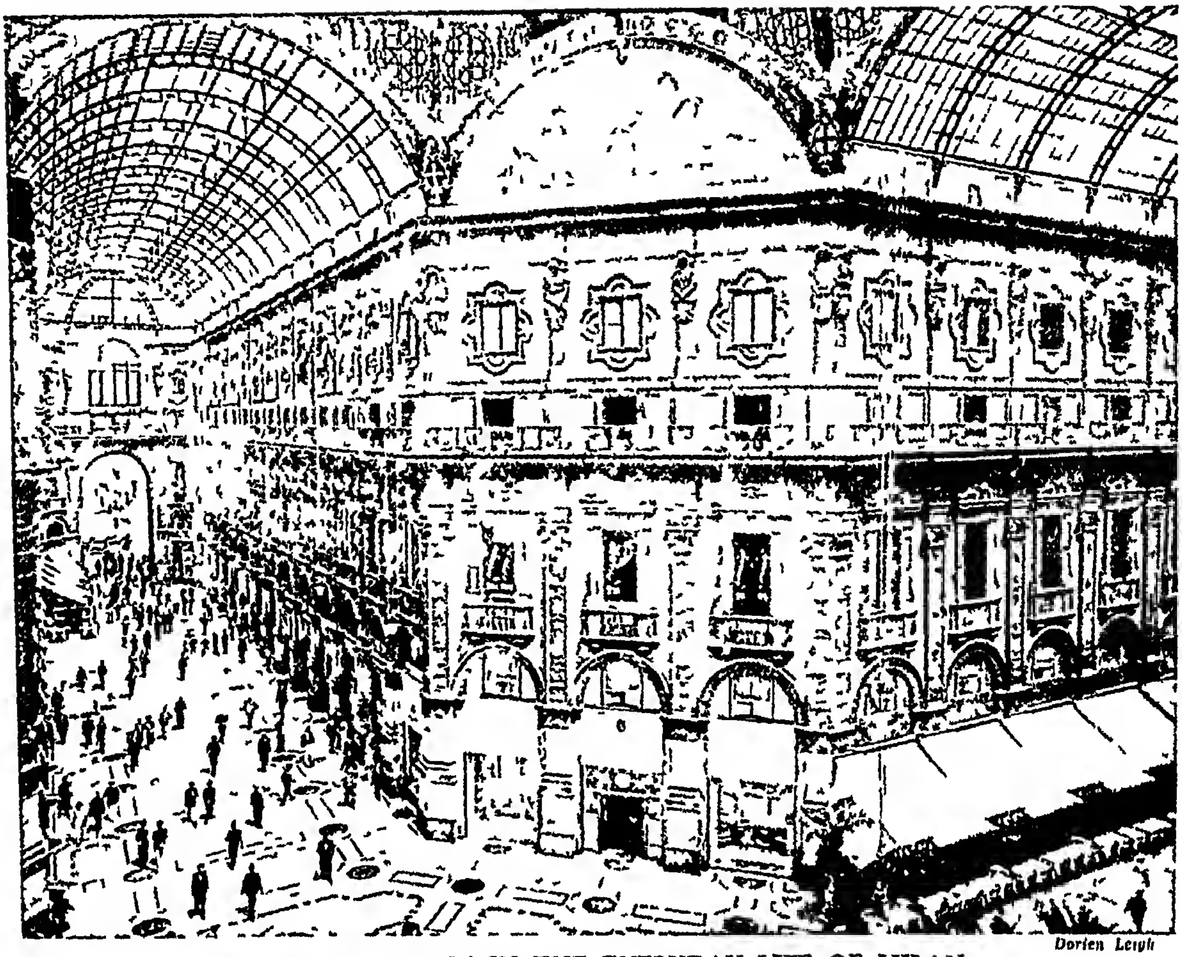
At length, in regions conducive to agriculture and the support of large numbers in comfort, men began to live together in communities or towns The first of these grew up along the banks of the Nile in Egypt, and in the valley of the Tigris and Euphrates in Mesopotamia This civilization lasted about 3,000 years, and was finally wiped out by a great migration of energetic shepherd folk from the grasslands bordering the Caspian Sea We call these people Indo Europeans because they flocked into both India and Europe They became our ancestors

The Indo-European parent people pushed out branches in several directions A group of tribes swept south-east to the plateau of Iran, from which they were named "Aryans" This group later split up into two the one developed the great empire of the Medes and Persians, the other colonized India Meanwhile another group of Indo-Europeans advanced across the Aegean Islands into the rocky peninsula of Greece Not long after, others invaded the Italian peninsula and founded the empire of Rome Some tribes swung southward, coming into collision with the Semites whom they drove into Arabia and Africa Others spread northward over the plains of Russia and became the Slavs while those who went up the valley of the river Danube became the Celts, later followed by the Teutons, who settled around the Baltic

These migrations from Asia were irregular, and sometimes required centuries to accomplish The young and vigorous peoples who came into Europe in wave after wave developed new and different civilizations by the combination of one set of customs with the different customs of other people It was this intermingling of civilizations that speeded up progress

For more than a thousand years Greece and Rome were the centre of Indo-European culture In time Rome became over-populated, and had also to protect herself against invading barbarians So it was that Roman legions extended the sway of the empire over much of Europe, subjugating Greece and the countries round about the Mediterranean

During the 5th century A D came the great migrations of the Goths, Vandals, Alemanni, Franks, and others—barbarous tribes living in eastern and central Europe Stirred into



Dorien Leigh

A PIVOTAL POINT IN THE EVERYDAY LIFE OF MILAN

Besides its lovely cathedral and other old buildings Milan has many modern ones that call for little admiration The famous Galleria Vittorio Emanuele, which was completed in 1867, a great arcade in the form of a Latin cross, is the animated centre of the city's everyday life The leading bookshops are here and several famous restaurants, and it is the haunt of opera singers from La Scala, close by, and their impresarios

activity by inroads of Huns from Asia, they begun to flood the civilized world, and put an end to the supremacy of Rome Out of the break-up of the Roman dominion appeared the kingdoms and nations that gradually gave rise to modern Europe

Early migration from Europe to America was chiefly from Spain and England Japan and China today are over-populated, and their peoples are spreading into neighbouring lands Some writers even fear a descent by the yellow peoples on the countries of Europe The tendency to migrate is one of the strongest characteristics of the human race

Milan, (Pron mil an'), ITALY Standing on the River Olona in the midst of the fertile plains of Lombardy, Milan from the earliest days was the natural axis round which turned the stirring history of northern Italy

This position, which placed the city in the path of invaders armed with fire and sword, also made of Milan the gateway for commerce and prosperity, and while the need of self-protection developed courage and independence in the Milanese, they also waxed rich and powerful

Milan today is the centre of the financial life of Italy and the second largest city in the kingdom, being surpassed only by Rome Ever since it was taken from the Gauls by the Romans in 222 B C Milan has continued to grow, despite the fact that it was sacked and burned once by the Huns, twice by the Goths, and once by Frederick Barbarossa as late as 1162

After Milan had been rebuilt, following its destruction by Barbarossa, the city suffered a century of civil strife It then fell under the rule of the house of Visconti The last Visconti duke died in 1447, and three years later began the rule of the Sforzas, continuing to 1535 Most of the ancient beauty of the city is due to these two famous houses When the Sforza line died out, Spain seized Milan and held it until 1714 It was under Austrian rule until Napoleon created his short-lived kingdom of Italy and made Milan its capital After Napoleon's fall in 1815, Milan was restored to Austria In 1859 it became part of United Italy

The famous cathedral is on the Piazza del Duomo—the centre of the city's life It is the third largest in Europe, surpassed only by

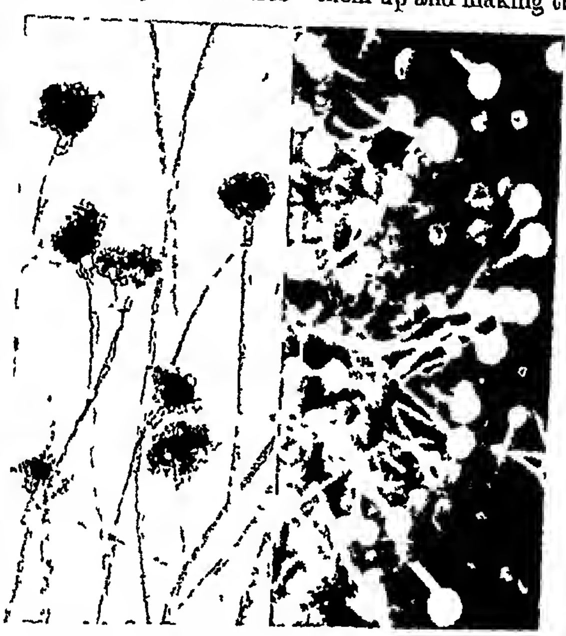
St Peter's at Rome and the Cathedral of Seville Forty thousand people can worship in it at the same time The foundation-stone was laid in 1386, but it was not completed until 1812 The cathedral is 486 feet long and towers 356 feet from the ground The style is Gothic, very elaborately decorated, and there are more than 3,000 statues in its niches (*See* illus page 1563)

Second in importance among the many churches is that of Sant' Ambrogio, built by St Ambrose in the 4th century, but twice destroyed and rebuilt Here St Ambrose baptized St Augustine (*q v*)

Milan has always been a seat of art and learning Its artistic and literary life centres about the Brera Palace, the home of the Academy of Fine Arts and Science Here is one of the finest picture galleries in Italy, containing paintings by Raphael and other great masters

The city has two famous libraries, a large government school of agriculture and commerce, and the second largest opera-house in Europe, the Teatro della Scala Its academy of music is one of the oldest and finest in Europe The archaeological museum of Milan is also celebrated

The largest factors in Milan's industrial life today are textiles and machinery Locomotives and other railway equipment, also motor-cars, electrical supplies, carriages, and rubber goods are important articles of manufacture Here are centred the silk, artificial silk, and cotton industries of Italy Milan has an airport and a huge railway station—claimed to be the largest in the world The population of Milan is 1,103,960



MOULD AND MILDEW MAGNIFIED

The left-hand picture above shows the spore-bearing heads of the common blue mildew, Penicillium glaucum, while on the right is seen the extraordinary appearance of a tomato attacked by the mould, Mucor Both these pictures are very highly magnified

Photos J J Ward E A Botting

Mildews and Moulds We frequently find small downy or velvety patches called mildew or mould on the surface of leaves, fruit, damp cloth, moist foodstuffs, etc Sometimes the growth covers a large area with a very thin film of soft cottony tissue By using a magnifying glass we can see that the growth is composed of a great number of tiny plants, so small that separately they cannot be seen by the naked eye If we use a high-powered microscope we can see the structure of these tiny plants, and we discover that their thread-like bodies cover the surface on which they grow with a network of delicate cobweb-like strands or filaments—these are called *hyphae*, and they combine to form the *mycelium*

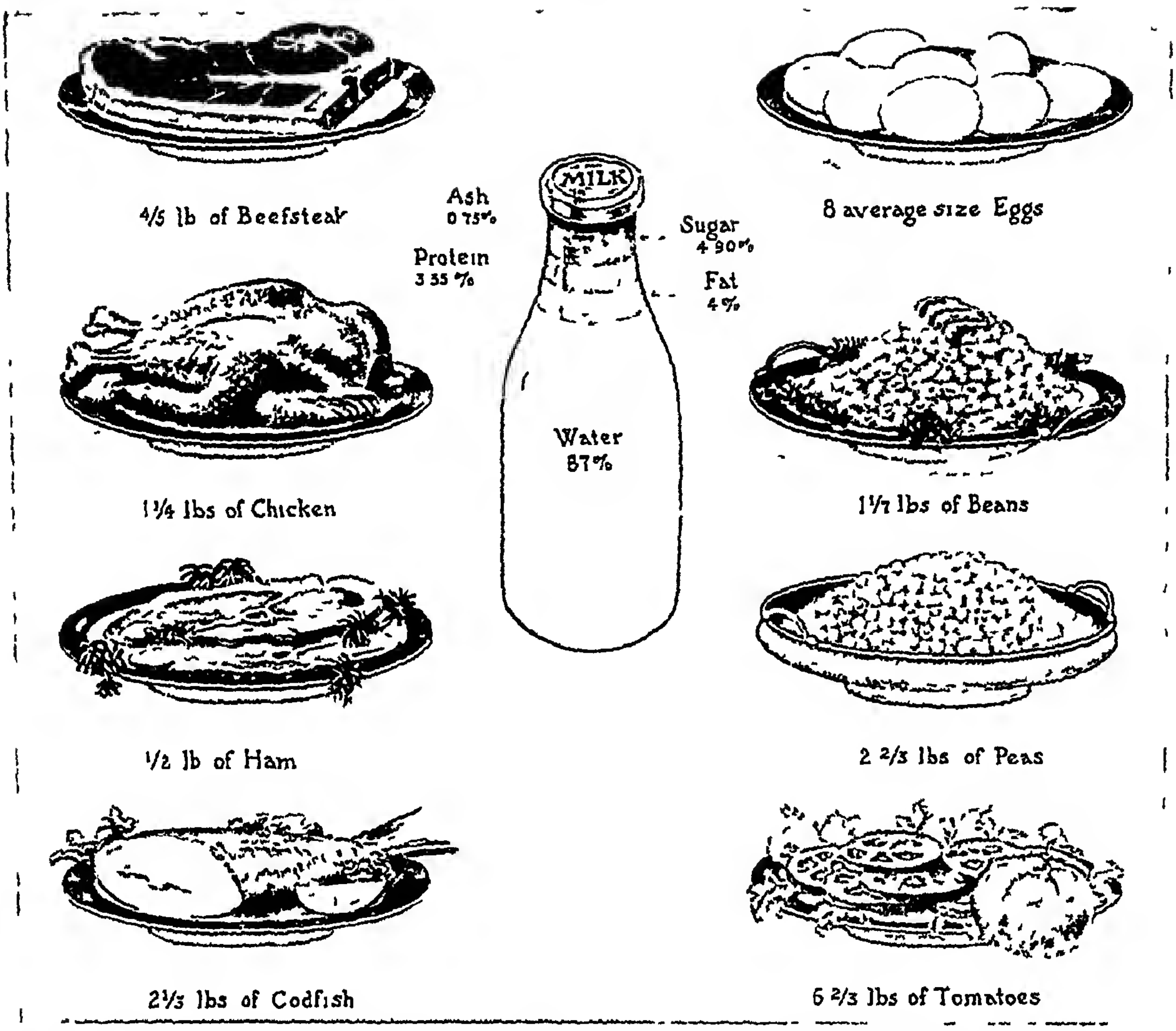
Mildews and moulds are members of the *fungi*, which include toadstools, mushrooms, and similar forms Like all fungi, they are either parasites, living upon the bodies of other plants larger than themselves, or saprophytes, living upon dead vegetable and animal matter

"Downy mildews" usually grow within the tissues or cells of plants, and thus do a great deal of harm to the stems and leaves, drying them up and making them curl and twist One of the best-known of these is the grape mildew, the larger part of whose thread-like body grows within the grape leaf, and sends out upon the surface masses of fibres, which appear to the naked eye as small white patches These patches generate tiny spores, invisible to the naked eye, which are carried by the wind to other leaves, where they take root and grow into new mildew plants

Powdery mildew can be removed from plants by dusting them with sulphur powder, or spraying them with some good "fungicide" or liquid used for killing fungi The spores of green and black mould exist in the air almost everywhere That is why damp bread and other food left standing in kitchens will almost always become covered with a furry green coat To protect food from these moulds, it should be kept in dry airy places The best way to keep plants free from mildew is to provide proper ventilation (*See also* Fungus)

Milk. Every human being lives for a time entirely upon milk Indeed, milk is the chief food of all the higher animals or mammals during babyhood, for the food elements needed to build and nourish brain, muscle, and bone are found in milk in the most easily digested form There is no substitute for milk in infant feeding, and milk and milk products are most important foods at all ages

Health experts say that not enough milk is drunk in Britain The average consumption per head is only 2¼ pints a week—less than half



THE VALUE OF MILK AS A PRODUCER OF ENERGY

We need food for a variety of purposes—to build body tissue, to supply fuel for maintaining body heat and activity, and to maintain a reserve of fat This diagram shows how valuable *milk is as an energy* producer—that is, for making "body fuel' The quart of milk in the centre of the picture is equivalent in "energy value," measured in calories, to any of the other quantities of foodstuffs shown Its efficiency as a body builder, which depends upon its protein content, is also high It is, too, easily digested

that in the U S A and Sweden To encourage milk drinking, the slogan "a pint a day" is used by the Milk Marketing Board, which is the legally established central body dealing with the nation's milk supply In many schools a scheme has been inaugurated whereby one-third of a pint is issued to each school child for only ½d (*See* illus p 1692) There are now many "milk-bars" in London and the provincial cities

Great efforts have been made in recent years to ensure the cleanliness of milk We now have on the market not only "Grade A" milk, but also milk guaranteed to have been pasteurized, sterilized, or tuberculin-tested Sealed bottles are now often employed, and many other people drink their milk out of a hygienic carton with a straw Many distributors, who are engaged in a vast industry that is at work long before we get up, use special glass-tanked lorries to deliver their supply to the depots (*See* illus p 1689) Similar trucks are used on the railways to convey milk from dairy-farm centres to the large towns

Among English-speaking people, the cow furnishes by far the largest share of the milk supply, but the Laplander drinks the milk of reindeer, the Beduin of the desert get their milk from the camel, and the roving Tartar drinks mare's milk Sheep, goats, asses, buffaloes, and even zebus contribute, in one region or another, to the world's milk supply The milk of goats and ewes is rich in fats and is used in making some of the most famous European cheeses The raising of milch goats is a prominent industry in Switzerland, and is being encouraged in England and the U S A

But whatever its source, all milk contains the same valuable food elements, though in different proportions In good cow's milk there is about a quarter of a pound of food solids to every quart—as much as in three-quarters of a pound of beef

The most important of these solids are (1) butter fat, the chief constituent of butter, (2) casein or curd, which forms the body of

cheese, (3) milk-sugar, or lactose, which is less sweet than cane-sugar, (4) ash or mineral salts, which builds bone

Milk is the hardest food to replace in the diet because it is a rich source of calcium, which few other foods have The vitamin content of milk, especially vitamin A, is important, and particularly necessary to the growth and vigorous health of children (*See* Vitamins) The casein of milk, moreover, is more easily digested than any other protein, and milk-sugar is more readily assimilated than any other kind of sugar

Of the many milk products, butter (*q v*) is the most important, because it is largely made up of the valuable fats Cheese (*q v*), which is made in a great variety of ways in the various countries, is rich in casein as well as fats Ice-cream is a valuable food, since it contains all the milk solids, unless it has been adulterated Evaporated milk is whole milk with part of the water removed Condensed milk is similar, but with sugar added as a preservative

To make powdered milk, the heating is continued until nearly all the water is evaporated, and the thickened milk is then sprayed into hot air so that the dried milk falls in fine powder Besides taking up less room than fresh milk in storage and shipment, evaporated, condensed, and powdered milk can be kept indefinitely and be shipped long distances By simply adding water a product is obtained closely resembling fresh milk After the removal of fats and casein to make butter and cheese, the whey still contains milk-sugar This is removed for use in the making of infant foods and "sugar-coated" pills

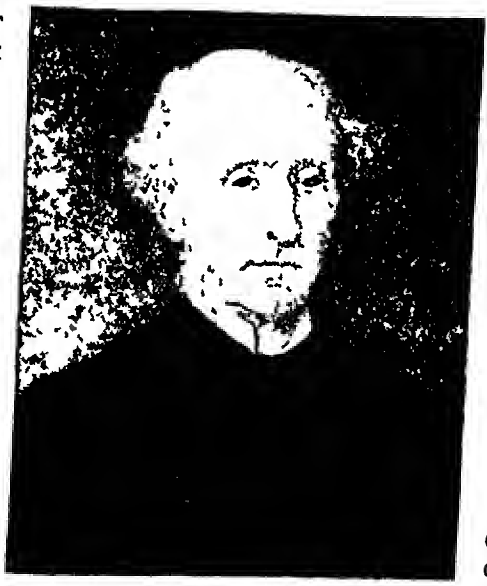
Butter-milk, the fluid which remains after churning for butter, is a nutritious and popular drink It gets its acid flavour from the conversion of much of its sugar into lactic acid There are several fermented milk drinks, the best-known of which is the koumiss, originally made by the Tartars from mare's milk This is now made on a large scale from cow's milk in Europe and America for invalids Malted milk is made by mixing whole milk with the liquid obtained from a mash of ground barley, malt, and wheat flour, and drying into a product like powdered milk

Casein has a wide use in the industrial arts in addition to its use as a food It is used in the manufacture of coated papers to produce the smooth surface necessary for fine half-tone printing It also enters into the manufacture of oilcloth, water paints, and various kinds of enamels Hardened by a special process, it makes an artificial plastic-like celluloid used for buttons, electric insulation combs, etc

In 1935 Italian chemists, when foreign supplies of wool were cut off, invented a process for making artificial wool, called lanital (*see* illustration in page 1065), from casein

Mill, JOHN STUART (1806–1873) One of the foremost thinkers of the 19th century, and a political economist whose writings are still very frequently quoted, John Stuart Mill was born in London, *May 20, 1806*

The son of James Mill, himself a philosopher and historian of great learning, he was very carefully educated It is said that he could read Greek at three years of age, and that, by the time he had reached the age of fourteen, he had a good knowledge of an extraordinary number of advanced subjects He entered the service of the East India Company, in which his father held a high position as a clerk, and remained there for thirty-three years, finally occupying his father's old post During the whole of his life he wrote extensively for the reviews, and published many books on political economy He also entered Parliament, and corresponded with all classes of people, from Carlyle down to humble labourers, on public questions



JOHN STUART MILL

Famous son of a famous father, J S Mill was the greatest economist of the Victorian Era That he was interested in other things than economics is clear from his "Autobiography"

After G F Watts National Portrait Gallery

Mill was a man of very liberal views and a recognized leader of the Utilitarian school of political philosophy, *i e*, of those who held, with Jeremy Bentham (*q v*), that the "happiness of the greatest number" should be the object aimed at in legislation His writings are couched in a very clear and readable style, and though his views on political economy (or economics as we usually call it today) are now somewhat out-of-date, his little books, "On Liberty," "Representative Government," and "The Subjection of Women"—particularly the first—are still perhaps the best on their particular subjects Not the least of Mill's claims to be remembered is that he was one of the first to advocate votes for women

He died at Avignon, May 8, 1873, and is buried there beside his wife

Millet. One-third of the world, it has been estimated, uses millet for its food In the densely populated Asiatic countries and in

PORTUGUESE MILLET HARVEST

One of the chief cereal crops millet is a grass of which various types are cultivated That shown here has long seed-heads, which are being swept in great masses into a barn

many parts of Africa the great variety of seed-bearing grasses to which the name is applied form the chief cereals, the seeds being ground up for meal, or sun-dried, or even eaten raw

Millet is also used for poultry food and bird seed, for fodder, and for enriching the soil

Millets have been cultivated since prehistoric times They are very prolific, indeed, the name has been thought to come from the Latin *mille*, thousand Durra is the grain of the Indian millet The chief species of commerce are common, barn-yard, and Italian millet

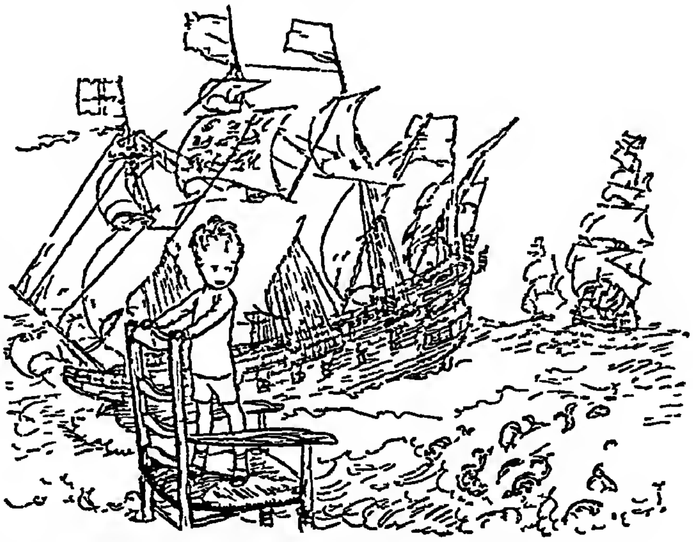
Millet, Jean François (Pron mē′-yā) (1814–1875) Amid rural scenes in Normandy the great artist of peasant life, Millet, spent his early days, and the love of Nature and the true life of the peasants that in later years he put on canvas were the priceless heritage of his own upbringing The parents of Millet were farmers—intelligent pious people, who lived the peaceful yet toilsome life of all those whose work is on the land

As soon as he was old enough he had to work with his father and mother in the fields But the noon rest hour gave him a little time in which to draw pictures, and at night he read and studied When he was 18, the family savings were put together and he was sent to the neighbouring city of Cherbourg to study art Eight years later he first exhibited at the Paris Salon

After living in various parts of Normandy and in Paris, Millet settled in 1849 in the little village of Barbizon, on the borders of the forest of Fontainebleau, near Paris Here, living once more among the peasants, he produced that famous series of pictures you know so well, "The Man with the Hoe," "The Water Carrier," 'The Sower," "The Gleaners," and "The Angelus" (*See* illustration p 1730)

Artists and students understood Millet and his pictures, but he was not publicly appreciated for many years Yet through him arose the famous group of painters known as the Barbizon school (*See* France, Art of) Just when he was becoming generally recognized, his health failed, and he died January 20, 1875

Milne, Alan Alexander (born 1882) A A Milne started his literary career as editor of "The Granta" at Cambridge in 1902, and afterwards joined "Punch," being assistant editor from 1906 to 1914 Real fame did not come to him until 1924, with the publication of 'When We Were Very Young," a volume of children's verses Christopher Robin, the hero of this book and its successors—"Winnie-the-Pooh" (a full-length story), "Now We Are Six" (verses), and "The House at Pooh Corner' (short stories)—was in reality the author's small son Several of the incidents in these modern children's classics have been set to music Many of Milne's plays have also proved popular, including "Mr Pim Passes By," "The Dover Road," "Toad of Toad Hall" (an adaptation of Kenneth Grahame's "Wind in the Willows"), and "The Truth about Blayds"



'WHEN WE WERE VERY YOUNG'

This is the name of A A Milne's most popular book, a collection of verse written mainly about his own small son, Christopher Robin, whom you see here, drawn by E H Shepard, playing in his arm-chair sailing ship

Courtesy of Methuen & Co Ltd

GREAT MAKER *of* MAJESTIC VERSE

England's second greatest poet was John Milton, the most lasting product of the Puritan period and writer of the only memorable epics in our language. His life below is followed by the story of "Paradise Lost"

Milton, John (1608–1674) Milton was born December 9, 1608, eight years before the death of Shakespeare To quote his own words "I was born in London, of a good family, my father a very honorable man " His father was a cultivated gentleman, a distinguished musician, and a well-to-do "scrivener" (a sort of attorney and financial agent)

Like his father, John came to be an accomplished musician, he is said to have had "a delicate tunable voice, and great skill " By his ninth year he was writing verse, and under private tutors perfecting his Latin and Greek At 12 he was entered at St Paul's as a day scholar After that age, he tells us, he scarcely ever quit his lessons before midnight The brilliant boy was trained to the limit of his capacities and beyond the limits of his health and eyesight By the time he left school for Cambridge in his 17th year, he was well acquainted with French, Italian, and Hebrew, as well as Greek and Latin

Milton was at Cambridge from his 17th to his 24th year He was a strikingly handsome young man, far advanced in his studies beyond his fellow students His early biographers agree that he " was a very hard scholar at the University, and performed all his exercises there with very good applause "

Milton left the university in July, 1632, with a sense of relief His father, who was almost 70, had taken a place at Horton, a Buckinghamshire village Here Milton settled to the arduous task of preparing himself for immortality through " things unattempted yet in prose or rhyme " Here in trial flight, as he called it, he wrote " L'Allegro," " Il Penseroso," " Comus," " Lycidas," and some of his sonnets

In 1637 his mother had died Approaching his 30th year, with such stupendous hopes and with so little yet accomplished, alone at Horton with his aged father, he began to be irked by solitude and obscurity, and he set out on a continental tour From Paris, where the English Ambassador entertained him, he moved on to two months in Florence, where " I found and visited

ANDREW MARVELL GREETS MILTON AT CHALFONT ST GILES

This is " The Meeting of Milton and Andrew Marvell at Chalfont St Giles," a painting by G Boughton, R A In fine weather, Milton delighted to sit outside his house to receive his visitors Marvell, who achieved fame as a poet and satirist, had been of service to the blind poet when he was Latin Secretary to the Council of Foreign Affairs The bust after Edward Pierce (in the small picture above, left) is in the National Portrait Gallery

MILTON'S COTTAGE IN THE COUNTRY

To this "pretty box" in the Buckinghamshire village of Chalfont St Giles the great Puritan poet retired in the summer of 1665, when the Great Plague swept through London It is now a Milton museum

the famous Galileo, grown old, a prisoner of the Inquisition" After two months in Rome he moved on to Naples, where he was checked by news that civil war was brewing in England and gave up his plans to visit Sicily and Greece "I thought it disgraceful, while my fellow citizens fought for liberty at home, to be travelling for pleasure abroad" But he took his time in returning home, spending six more months in Italy, and tarrying a while in Geneva

Milton had been away 15 months He found that in those troubled times the household at Horton had been broken up, and the family fortunes sadly depleted "I hired for myself and my books a large house in the city (London), where I happily resumed my interrupted studies" There, about to embark on "the troubled sea of noises and hoarse dispute" as a writer of pamphlets, he undertook the education of the two sons of his sister, Mrs Phillips Later he took other pupils as well The Long Parliament was called in 1640 In 1641 Milton launched the first of his pamphlets—the gun that opened his 20 years of political warfare, attacking the corruptions of State and Church and upholding the ideals of the Puritans

In the spring of 1642 (or possibly 1643) Milton visited a Royalist family that lived near Oxford He returned a married man—a 35-year-old husband with a pretty 17-year old bride, Mary Powell It was an unhappy marriage Mary, says an early biographer, "found it very solitary, no company came to her" After about a month she went back to her family, promising to return soon She was away three years Under the spur of his unhappy situation he wrote a pamphlet on "The Doctrine and Discipline of Divorce," advocating freedom of divorce In passionate language, often of haunting beauty, he set forth ideals of marriage that even today sound rather "advanced" The pamphlet was greeted by a storm of insult, and by an attempt to prosecute him for unlicensed printing In reply he wrote the masterfully eloquent "Areopagitica," the most able defence of the freedom of the press ever written

From 1645 to 1649 Milton rested his pen and remained a silent witness of the Civil War But a few days before the execution of Charles I Milton's voice again arose—it was the first to rise—upholding the right of the people to execute a guilty sovereign With astounding courage (or the audacity of desperation) he published the "Tenure of Kings and Magistrates" in January, 1649 In March of the same year he was appointed secretary for foreign tongues under Cromwell His duties were to conduct correspondence with foreign states and to write pamphlets setting forth the views of the government To that task he deliberately sacrificed his eyesight Complete blindness came to him in 1652

DICTATING HIS LAST POEM

Here we have an artist's impression of Milton, now blind and out of favour with the world, composing 'Samson Agonistes,' the last of his great Scriptural poems

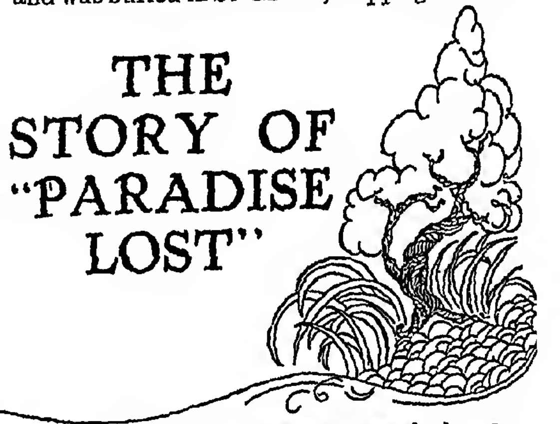
Painting by J C Horsley R A

Worse even than blindness was the shattering of all his ideals and hopes with the downfall of the Commonwealth in 1660 The House of Commons ordered him to be arrested and that all copies of his pamphlets defending the execution of Charles I should be burned by the hangman Through the good offices of powerful friends at court he escaped prosecution, but he was actually taken into custody by an officer of the House and released only after the payment of large fees

Now in his 52nd year, blind, embittered, and cramped by the loss of a considerable part of

his fortune, Milton was free to resume the poetic task which he had given up twenty years before His household consisted of three daughters, borne to him by his first wife, who had returned to him in 1645 and had died seven years later His second wife, Katharine Woodcock, whom he had married in 1656, had died within a few months His motherless daughters, we are told, gave him much trouble, rebelling against the drudgery of reading to him and writing at his dictation Finally in 1663 he won domestic peace by taking a third wife, Elizabeth Minshull, a woman thirty years his junior

With dauntless courage Milton set about the task which he had long meditated Nothing in literature is more magnificent than the picture of the blind Puritan dictating day after day the superbly rolling periods of his great epic, "Paradise Lost" During the Great Plague of 1665 Milton retired to a cottage, still preserved, at Chalfont St Giles Two years later his task was completed, and the world received the book which has had an influence on English thought and language surpassed only by the influence of the Bible and the plays of Shakespeare The remaining seven years Milton devoted to his second epic, "Paradise Regained," and to his tragedy, "Samson Agonistes" He died Nov 8, 1674, and was buried in St Giles's, Cripplegate London



THE STORY OF "PARADISE LOST"

IN this great Puritan epic Milton tells the story—

> Of Man's first disobedience, and the fruit
> Of that forbidden tree whose mortal taste
> Brought death into the World, and all our woe,
> With loss of Eden

The poet plunges right into the heart of the great events which led up to the expulsion of Adam and Eve from Paradise He takes us first to the abyss of Hell, into which the hosts of Heaven had hurled Satan and the other rebellious angels,

> Hurled headlong flaming from the ethereal sky,
> With hideous ruin and combustion, down
> To bottomless perdition, there to dwell
> In adamantine chains and penal fire,
> Who durst defy the Omnipotent to arms

There they lie stretched out in their vast length along the burning lake, until Satan, concealing his despair, boasts that they will be successful in a second war on Heaven

God in Heaven hears his speech, and lets the flames die down so that Satan may "heap on himself damnation" by a second trial He rises on huge pinions above the lake, alights on the shore, and proclaims defiantly to the dreadful realm of Hell

> Receive thy new possessor—one who brings
> A mind not to be changed by place or time
> The mind is its own place, and in itself
> Can make a Heaven of Hell, a Hell of Heaven

The rebel chief than marshals his forces, and in an hour builds a huge palace of gold and bronze and marble, more beautiful than any palace of Babylon A council of war is held at once, and Satan tells the assembly that he has heard rumours of a new world and a new race called Man whom God is about to create, and that perhaps these beings may be seduced to revolt No one else is bold enough to undertake the perilous mission of finding this new world, so Satan takes it upon himself He passes out by the gates of Hell, guarded by the foul monsters Sin and Death, after promising them the new race for their own

Through the dreadful abyss of "Chaos and ancient Night" the Fiend wings his way, skirting the wall of Heaven and finally alighting on the Sun There he takes the form of a "stripling cherub," in whose face "youth smiled celestial," so completely disguising himself that the good Archangel Uriel, whom he meets, shows him the way to the Earth

Triumphantly Satan speeds thither, alighting on a mountain-top not far from the Garden of Eden, the Paradise of delight in which God had placed the newly created parents of the human race

He then finds his way to the Garden, and, disdaining the gate, leaps over the barrier After admiring the gentle beauties of hill and vale, the rich verdure, the "odorous sweets," he finds the Tree of Life—the forbidden tree—and sits upon it like a bird of prey He looks out upon the wonders of the place, the living creatures, "new to sight and strange," and—

> Two of far nobler sight, erect and tall
> God like erect, with native honour clad
> In naked majesty
> For contemplation he and valour formed,
> For softness she and sweet attractive grace,
> He for God only she for God in him

These beings are Adam and Eve, who lead serene and happy lives in Paradise, which yields them "nectarine fruits" to eat as they sit—

> On the soft downy bank damasked with flowers

About them frisking play harmlessly the animals—

> Sporting the lion ramped, and in his paw
> Dandled the kid, bears, tigers, ounces, pards,
> Gambolled before them, the unwieldy elephant,
> To make them mirth, used all his might, and wreathed
> His lithe proboscis

In the shape now of a lion, now a tiger, now some other animal, the vengeful Fiend stalks round the happy couple and overhears the secret by which their downfall is to be worked—that the one command God has placed on them is not to eat of the fruit of the Tree of Knowledge When Satan hears this he exultantly says to himself

> O fair foundation laid whereon to build
> Their ruin!
> Live while ye may,
> Yet happy pair enjoy, till I return,
> Short pleasures for long woes are to succeed!

Soon Adam and Eve retire to rest for—

> Now came still Evening on, and Twilight grey
> Had in her sober livery all things clad,
> Silence accompanied, for beast and bird,
> They to their grassy couch, these to their nests
> Were slunk, all but the wakeful nightingale
> She all night long her amorous descant sung

When all has sunk to rest Gabriel, who guards the gates of Paradise, sends two angels to search the garden They find Satan crouched, "squat like a toad," at Eve's ear, trying to corrupt her mind by dreams They drive him forth, but the Fiend's work had already been done On awaking, Eve tells Adam of the dream in which Satan had told her that the forbidden fruit would make her a goddess

ADAM AND EVE BEFORE PARADISE WAS LOST

John Milton's grandest poem is based on the Bible story of Adam and Eve in the Garden of Eden But whereas the Genesis account is in the stately prose of Tudor England Milton's is penned in sonorous blank verse This picture reproduced from a painting by John Martin (1789-1854), illustrates an incident in the poem that is not in the Bible Adam and Eve, emerging from their bower in a glade of the garden, are confronted by the dazzling shape of the Archangel Raphael

Adam comforts her distress, and they sing a hymn of praise

The Almighty is not ignorant of the stir that Satan had raised in Paradise, nor of his baleful schemes, so He summons Raphael, "the sociable spirit," and bids him visit Adam and warn him of danger The winged spirit perceives Adam sitting at the door of his cool bower, while Eve is preparing dinner within Hospitably they invite the heavenly guest to share their meal of the choicest fruits of Paradise Seated on mossy turfs about a table of raised turf, they hold a long conversation

Raphael tells his hosts the story of Satan's rebellion and defeat, and relates the story of Creation He tells how, after the rebel angels had been hurled into Hell, God had made a new world and a new race to take the place of Satan and his hosts Adam in turn tells of his first experiences, how he had awakened to find himself lying on a bed of flowery grass, amid the warbling of birds and the murmur of streams And he describes how God, to relieve his loneliness, had taken from his side a rib, which He had fashioned into a creature—

> so lovely fair
> That what seemed fair in all the world seemed now
> Mean

After warning Adam against the wiles of the Evil One, Raphael departs Meanwhile Satan has been circling the Earth, and has decided to take the shape of the Serpent

In the morning Eve asks Adam to let her work apart from him that day Adam is fearful of danger, but at last consents, and Satan, greatly to his joy, finds Eve alone, "veiled in a cloud of fragrance" He goes towards her, "his head crested aloft and carbuncle his eyes" He

> Curled many a wanton wreath in sight of Eve,
> To lure her eye

Eve hears the rustling of his folds among the leaves, and is astounded that he uses the speech of Man He tells her that she should be admired by all the world—here in Eden there is only Adam to know how beautiful she is, and that he (the Serpent) had received his power of speech by eating the fruit of a certain tree

Eve answers

> Serpent, thy overpraising leaves in doubt
> The virtue of that fruit, in thee first proved
> But say, where grows the tree?

Satan leads her to the tree, and she recognizes it as the forbidden tree that bears the one fruit they may not taste, lest they die Satan says that threat is false, and he has eaten and has not died If Adam and Eve eat, they shall be as gods Eve listens to the tempter, and eats the forbidden fruit It seems to her that she has never tasted such delight, and she decides that Adam shall share with her in it Adam is horrified, but resolves to eat the fruit and, if needs be, die with her, since without her he cannot live And then, though

> Sky loured, and, muttering thunder, some sad drops
> Wept at completing of the mortal Sin,

> They swim in mirth and fancy that they feel
> Divinity within them breeding wings
> Wherewith to scorn the Earth

But soon their high spirits droop and they quarrel Sleep does not refresh them, and they are ashamed of their nakedness They make for themselves girdles of leaves, and then soon—

> The voice of God they heard
> Now walking in the Garden

God asks them why they hide, and they confess their guilt Adam says

> She gave me of the Tree, and I did eat

Eve, "with shame nigh overwhelmed," replies

> The Serpent me beguiled, and I did eat

God pronounces punishment first upon the Serpent, decreeing that he shall thenceforward creep on his belly, and shall be hated by woman evermore Eve's doom is to be always subject to her husband's will, and to bear children in sorrow Adam's is to till the ground in the sweat of his brow

Rejoicing in his successful villainy, Satan meanwhile returns to Pandemonium and boastfully relates his deeds before the assembly of the fallen angels He waits for their applause, to his surprise and dismay his ears are filled instead with the sound of hissing from innumerable tongues Amazed, he looks about, and sees that God has changed the rebel hosts into a den of swarming serpents with forked tongues, and —crowning horror!—Satan himself crawls on his belly, a monstrous serpent

Overwhelmed with grief, Adam and Eve at first wish for death, but gradually courage and hope return, and they resolve to bear their lot submissively Prostrate they fall on the spot where God had judged them—

> And both confessed
> Humbly their faults, and pardon begged, with tears
> Watering the ground

The Son of God presents their prayers to the Father and intercedes for them God accepts their repentance, and consents to the ultimate redemption of the race, but decrees that they must leave Paradise The Archangel Michael leads them forth from the Garden by the hand, while the fiery sword waves behind them and the Cherubim take their stations to guard the Paradise they had lost, and so they depart

> Some natural tears they dropped, but wiped them soon,
> The world was all before them, where to choose
> Their place of rest, and Providence their guide
> They, hand in hand, with wandering steps and slow
> Through Eden took their solitary way

Mind. Whatever men *mean by the* word 'I' when they say, "I know or believe, I suffer or rejoice," this is the mind of Man—it is that part of him which thinks, remembers, reasons, feels, or wills

The dictionaries tell us that mind is "conscious intelligence" or the "faculty of knowing" The brain is the main seat of the mind yet mind can scarcely be said to be absent from any tissue in which feeling resides, and some, with Herbert Spencer, the Victorian philosopher scientist, would even assume the existence of a "mind dust" diffused with matter throughout the universe Certainly an inter-relationship exists between the physical body and the mind, and this is so nicely balanced that for either to be well and normal, the other must be well also Thus the old Greeks were not wrong when they set up as their ideal "a sound mind in a sound body"

Psychology (*q v*) is the science which deals with study of the mind The modern tendency is to emphasize behaviour, or what the individual does, rather than conscious states

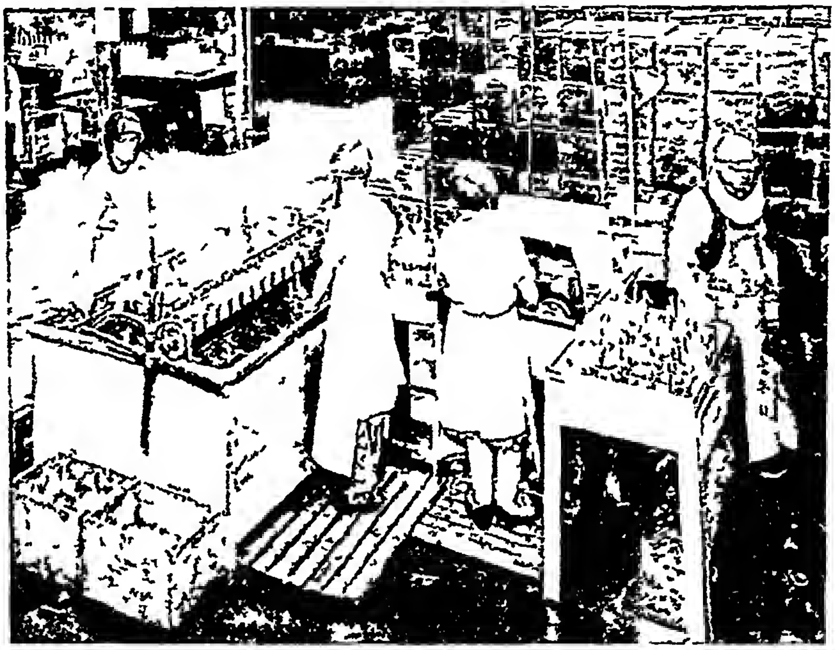
There are differences of opinion as to how far down the animal scale what is usually called mind can be traced Some writers hold it to be characteristic only of human beings, others see in the human being only a more complex manifestation of what is present to some extent in all animals (*See* Brain)

Some modern writers give mind a still wider meaning than is indicated above Thus Professor James Harvey Robinson, one of the leading American historians, has written a brilliant little book, "The Mind in the Making" in which mind is held to be the sum total of the "ordered knowledge" that has been accumulated and handed down to us from the past, and which we ourselves—or those of us who do any work in discovery, in research, or in properly directed thinking—may still further extend

Mineral Beverages. What is more refreshing on a hot summer day than a fizzing sparkling glass of lemonade or ginger-beer? And who, when ill and feverish, and parched with thirst, has not been grateful for a few drops of soda water, or soda-water and milk?

These drinks we owe to Nicholas Paul, who, as far back as 1790, began making beverages in Geneva to which he added carbon dioxide gas under moderate pressure For a long time these beverages were called carbonated waters, then they became known as aerated waters and today they are generally spoken of as mineral waters, although actually they contain no mineral matter, except perhaps, in a few cases, a little bicarbonate of soda

The process of manufacture is extremely simple, and can be carried out at home if you have a "gasogene" This is a double-flask, wire-protected siphon in which carbon dioxide gas is formed in the water in the small upper flask from prepared "cartridges" containing sodium bicarbonate and tartaric acid When these ingredients mix in water they liberate carbon dioxide gas in large volume, and this passes into the water in the large lower flask, which absorbs the gas under pressures varying from 100 to 200 lb per sq inch To minimize danger from explosion, all gasogenes must be protected by a wire covering of small mesh



FILLING SIPHONS WITH SODA-WATER

Here you see a corner of the factory where thousands of soda-water siphons are washed clean, filled, tested labelled, and packed every day You will notice that all the workers have their faces protected by special wire masks This is in case a cracked or defective siphon should explode after it has been filled The machine on the extreme right does all the filling automatically, forcing the right amount of carbon dioxide and water into the containers, which are then ready for testing and labelling

Courtesy of Schweppes Ltd

In large scale manufacture the gas is prepared in separate generators, and forced under pressure into the containers (siphons or bottles) to be supplied to stores and shops These have specially made stoppers, either screws or metal caps or "marbles" When the stoppers are removed, the difference between the atmospheric pressure and that of the gas-saturated soda-water or lemonade results in the liberation of the excess carbon dioxide, producing the sparkle and fizz with which we are all so familiar Today many aerated water manufacturers buy their gas in compressed form in steel cylinders

For soda, lithia, or potash waters about 15 grains of the bicarbonate salt of these minerals is

added to each pint of distilled water, and the mixture is then aerated For lemonade, orangeade, etc, small quantities of the necessary fruit-juice, syrup, or essence are added for flavouring purposes, while for ginger-beer a few drops of ginger essence are used

Mineralogy. A mineral is an inorganic substance existing in a natural state, and having a definite chemical composition, and mineralogy is the science of minerals Some minerals are uncombined elements, but more are compounds Some occur in both crystalline and amorphous (shapeless) form, while a few are known only as amorphous substances In most cases, the chemical composition and the crystalline form are the important features of a mineral specimen, while the external appearance is often of no scientific interest (You will see from this that we are using the term "mineral" in its narrow scientific sense, not in the broad one in which you use it, for example, in playing the game "animal, vegetable, or mineral")

Mineralogy studies the chemical composition, crystalline form, physical characteristics (such as lustre, hardness, specific gravity, and colour), formation, occurrence and uses of minerals of all sorts

The rocks and types of "earth" may be simple minerals such as quartz and kaolin, or each may be composed of several minerals, as in the case of rocks like granite

Minerals are the raw materials from which are obtained all the metals, acids, salts, and other chemicals except the organic chemicals, glass, porcelain, pottery, terra-cotta, and bricks, refractory materials from which fireproof curtains, furnace linings, etc, are made, many pigments, such as ochre and umber, and writing materials, fertilizers, like potash and nitrates, mineral fuels (coal, petroleum, and natural gas), and gems A single mineral may be the ancestor of a long line of useful derivatives Thus, common salt (sodium chloride) is the source of most of the other sodium salts

Minerals are classified according to their chemical nature and physical properties One of the most useful classifications is according to hardness on a scale of ten minerals, arranged in order from the hardest to the softest The hardest, the diamond, is given an arbitrary "hardness value" of 10, and the softest, talc, has the value 1 The complete scale is talc, 1, gypsum, 2, calcite, 3, fluorspar, 4, apatite, 5, orthoclase, 6, quartz, 7, topaz, 8, corundum, 9, diamond, 10

(*See also* the articles on the principal metals and other elements for further minerals used as ores, chemicals, pigments, etc)

MINERAL CRYSTALS

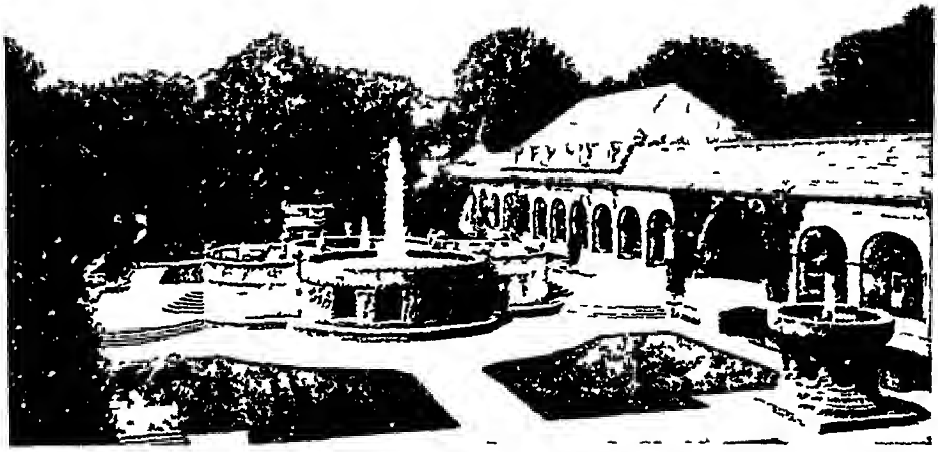
1, Marcasite, showing internal radial structure 2, Hopper-shaped crystals of salt 3, Hematite, with nodular exterior and crystalline internal structure 4, Dendritic pyrolusite 5, Olivine crystal 6, Pyrite 7, Octahedral crystals of magnetite in schist 8, Crystals of fluorspar 9, Quartz crystals

From specimens in the Geological Museum South Kensington

Mineral Springs. When rain falls on the land it oozes through the surface, dissolving as it goes the soluble minerals of the soil, and tending always, because water is heavier than earth, to seek lower levels Raindrop joins raindrop and the volume of water grows greater and greater, percolating through layer after layer of sub-soil until it meets with, say, a stratum of clay, through which it cannot easily pass

As the mass of water grows greater the pressure increases, at deeper levels it dissolves more mineral matter, its temperature is raised, and it holds in solution the many gases found in the earth—oxygen, nitrogen, ammonia, sulphuretted hydrogen, and others A time comes when both the increasing volume and pressure of this subterranean water force a passage *upwards* through the overlying material the result is a natural mineral spring

Although all drinking waters contain proportions of certain minerals, according to the soils from which they are derived, they are not classified as "mineral" waters This term is confined to waters from certain wells and springs which age-long experience has shown to possess a certain medical value Although the exact chemical composition of these mineral springs has long been calculated, medical science hitherto has been unable to account, by analysis alone, for the beneficial effects accruing from their use in certain diseases, because when artificial waters were prepared of the same composition, the same results were not obtained



A FAMOUS GERMAN MINERAL SPRING

Wherever mineral springs of medical value are found a spa soon springs up, to which sick folk go to 'take the waters', and such places become important centres of medical practice, like Bath, Harrogate, and Buxton in England This picture shows the principal spring and the attractive layout of the spa at Bad Nauheim, in the Taunus Mountains, Germany

The discovery that many spring waters were radioactive, and the knowledge that the majority of them occur in volcanic districts and issue forth at more or less high temperatures (thermal waters), led to the modern view that their efficacy is largely due to the radioactive state of their many mineral constituents, and their easier absorption owing to their higher temperature But even these new views do not account fully for all the medicinal virtues of mineral springs—virtues which the ancient Egyptian, Indian, Greek and Roman civilizations appreciated to a higher degree than we do today

Mineral springs are widely distributed over the globe

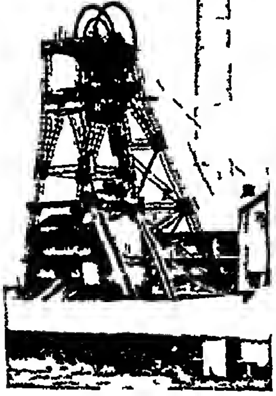
Different springs have different mineral contents, and are designated largely by terms indicating the mineral found most abundantly in them Thus some are called alkaline, because sodium and potassium are predominant in them, others sulphur or arseniated, and so on As a rule, however, most mineral spring waters contain fifteen or more mineral substances, some of the elements being present in minute quantities Sodium, potassium, lithium, magnesium, calcium, sulphur, arsenic, iron, manganese, fluorine, iodine, bromine, and rubidium would appear to be the most important of these

In addition to minerals, carbonic acid gas, hydrogen sulphide, nitrogen, hydrogen, oxygen, and ammonia are found dissolved in certain spring waters, and may conceivably exercise remedial effects

Extracting WEALTH *from the* EARTH

Possibly the most important industry of all, with the exception of agriculture, is mining, for the products won from the bowels of the earth are the raw materials for all heavy industry throughout the world

Mines and Mining Mining is one of the great basic industries, employing in Great Britain some 800,000 miners, of whom 615,000 work underground No fewer than 222,000,000 tons of coal—by far our most valuable mineral —were mined in 1935



"Prospecting," that is, exploring and testing territory to determine first the presence and then the extent and value of the deposits, is a complicated art The successful prospector of today must have some knowledge of mineralogy, metallurgy, and especially geology, which helps in determining the region in which useful minerals may be found, and often the actual locality for opening a mine Rusty-looking rocks may indicate iron Deposits of magnetic iron are often discovered by their influence on the magnetic needle The shape as well as the composition of stones or pebbles in streams is studied An ore-bearing pebble well worn and rounded has travelled a considerable distance, but if it is still angular the prospector will know that he should seek his mine close at hand

Suppose the prospector has finally determined that the desired mineral is present in a given region To ascertain the extent of the deposit he may make further examination by stripping off the soil of a considerable area, or he may dig shallow pits, or trenches Mining fields throughout the world are dotted with such excavations, each telling, in its abandonment, a story of some toiler's hope and failure

A more usual method of testing the ground is by borings, made by means of a diamond drill,

a long metal tube with black diamonds at the ends for cutters When rotated at high speed, the tube extracts a core of rock Holes have been thus drilled several thousand feet deep, in some cases at the rate of 60 feet a day In hard rock, however, the rate is very much slower

If these explorations indicate valuable ore, the prospector or the company stakes out a claim and begins to develop a mine Mining methods vary according to whether the minerals are found (1) in alluvial deposits (gravel, sand, silt, etc) on the surface, (2) in layers or beds beneath the surface, like iron ore, coal, and salt, or (3) in veins or seams (often called "lodes"), some of which are merely fillings in old cracks or fissures in rocks

Fox Photos

HEWING COAL IN A SOMERSETSHIRE MINE

Deep down in the bowels of the earth this miner follows his dangerous trade, hewing out the coal which is the very basis of Britain's industrial activity The seam in which he is working is but 2 feet high, and his only light is the little lamp fixed in his cap

Mining in alluvial deposits is called placer mining Placer mining is carried on in various ways, but the essential thing is to cause water to flow over the sand and gravel, so as to wash away the lighter material and leave the heavy and useful mineral behind (*See* Gold) "Open-pit" mining is the term applied where ores are uncovered and scooped out by steam shovels

For vein and bed deposits beneath the surface tunnels or vertical or inclined shafts are dug Tunnels are made especially where the ore body lies in the side of a mountain Tunnels form the best method of mining, for conveying ore horizontally out of a tunnel is much cheaper than hoisting it up through a shaft, and by having the tunnel on a slight incline drainage or pumping expenses are curtailed

When a shaft is sunk, tunnels called "drifts" and "cross-cuts" are dug sideways from it at different levels and in various directions into the mineral seams Thus an elaborate mine is like an underground city with an orderly arrangement of streets and alleys, though not all on one level Some mountains are honeycombed with such underground workings Where practicable, these passageways are made to slope down a little towards the mouth of the tunnel or towards the central shaft, so that the water may flow out of the tunnel or drain into the "sump" or pool at the bottom of the main shaft, whence it is pumped out

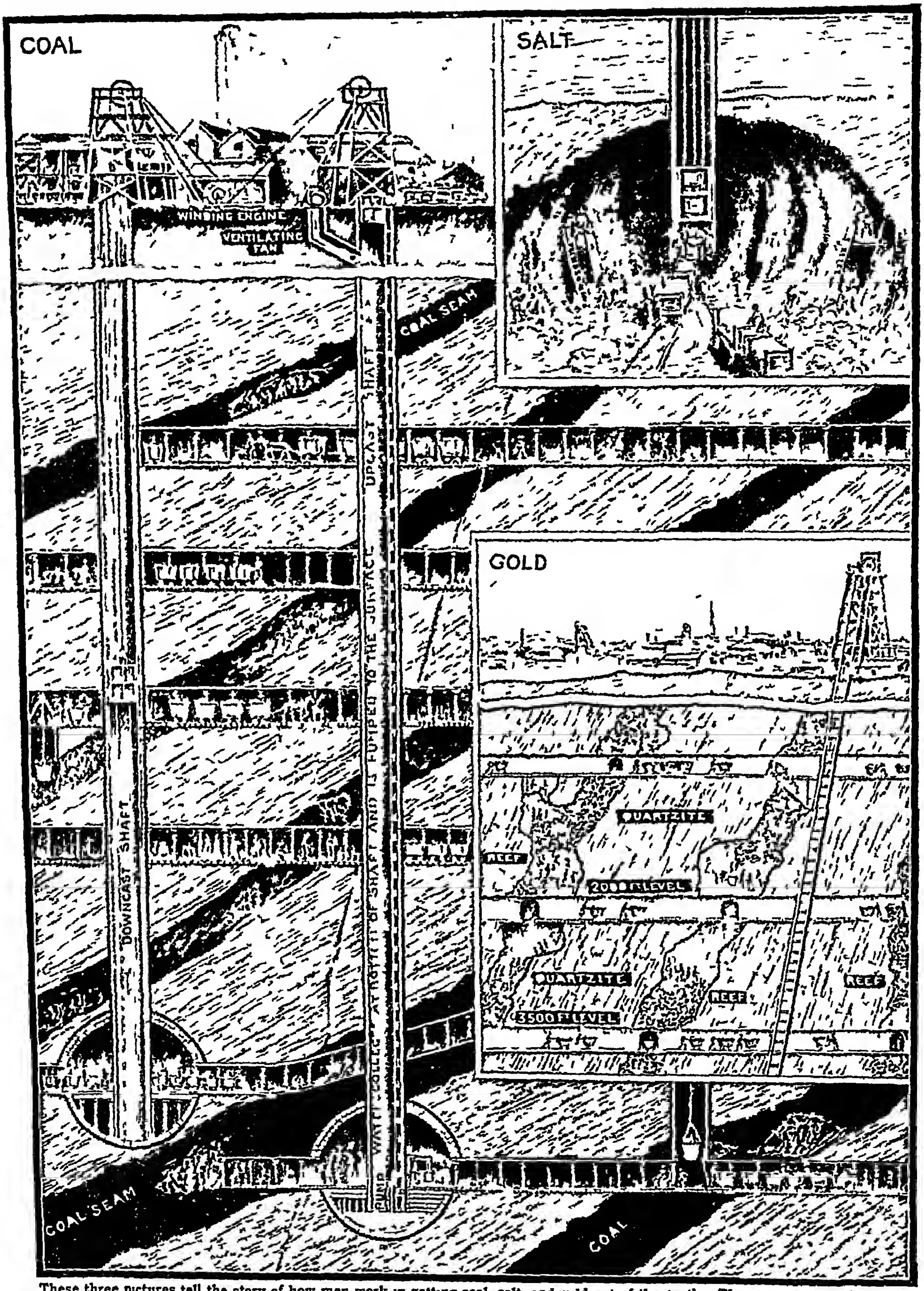
The different levels of a mine are connected by auxiliary vertical shafts or "winzes" The ore between the various openings is said to be "blocked out" Ventilation is accomplished in shallow mines by an air shaft In deeper mines large rotary fans or blowers, driven by steam or electricity, are used to suck fresh air into the far corners of the mines

Mine buildings, constructed frequently of galvanized iron, with towering pipes and smoke-stacks, resemble great mills A huge building is erected over the mine entrance in many cases Often separate buildings are constructed for the mining machinery, engineers' offices, labour quarters, and storage of explosives, etc

Now let us visit a coal-mine to see how it is worked, since coal-mines have much in common with all underground mines Unless the mine is lighted by electricity the grimy miner wears hooked into his belt an ingenious safety lamp (*see* Davy Sir Humphry), or a candle or small lamp on his cap He is carried down into the depths of the pit by a lift-like hoist called a "cage," passing the various levels just as you pass busy floors in a factory lift Following the main tunnel at the level on which he is to work, he passes through a branching gallery until he reaches the black shiny wall of coal called the "working face" Then, perhaps lying on his side, he begins to break down the coal He uses a pick, a shovel, a steel rock-drill—driven by steam, electricity, compressed air, or even a hand hammer—and various pneumatic or electric cutting and digging machines, such as the "undercutter," which undermines a ledge of coal by means of an endless chain, in which knives travel round in a frame Such machines are often mounted on rails, being moved along from place to place as the cutting proceeds

The drill is employed chiefly in blasting The miner drills small "bore holes" in the coal and inserts charges of black powder, which are touched off with an electric current A muffled roar, and the working face of the mine crumbles, the coal falling down in great chunks As the coal is removed the mine roof is

MINES THAT ARE LIKE THE HOMES OF GIANT ANTS



These three pictures tell the story of how men work in getting coal, salt and gold out of the earth The general principle in all is much the same the excavated material being brought to a shaft and hoisted to the surface You can see also how the veins or seams of the minerals are followed by the miners in their underground burrowing

supported by leaving pillars of coal at intervals, or by using timbers, for one of the greatest of mine terrors is the danger of the roof caving in Accidents in which hundreds have been entombed alive are numerous Extreme precautions against such accidents are now taken in all intelligent mining, but terrible explosions still occur, causing such ghastly disasters as that at Gresford Colliery (Wales) in 1934 when 264 lives were lost, including several brave men who went to rescue their comrades

Ponies in the Mine

The miner next sorts the coal and loads it on small trucks or "dump" wagons on tracks The cars are hauled to the main shaft by compressed air or electric locomotives, or by ponies and horses, the animals being quartered in subterranean stables and living their entire life in the mine, sometimes rarely seeing daylight In China, Mexico, and South America ore is still carried on men's backs

Hoists, called "skips," convey the coal up the main shaft into the daylight On the surface it is dumped down chutes into the "breakers"—an assemblage of inclined planes, screens, and chutes—which sort the coal into various sizes and grades From the breakers the coal falls into bins or dumps, and is then ready to be taken to market

In ore mines other processes take the place of the coal breaking In many cases the masses and lumps of ore, after being brought to the surface, are crushed, or even ground to powder, often by the pounding of huge hammers in a stamp mill The valuable part of the ore is then separated from the waste, the process of separation being different in varying cases Where the ore is much heavier than the waste, the separation is brought about through differences in specific gravity The final extraction of the metal, like the preliminary treatment of the ore, differs with the nature of the ore

EQUIPPED FOR RESCUE

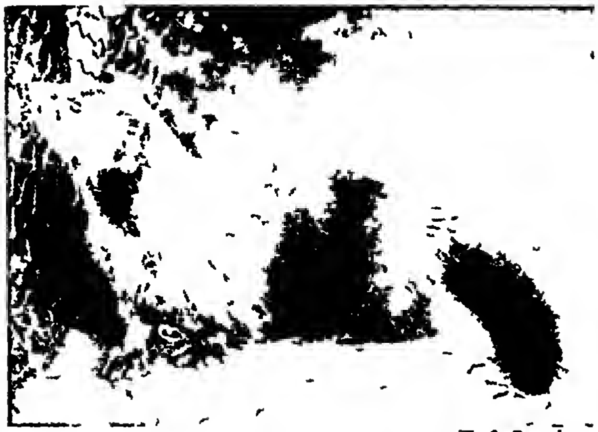
When there is a disaster in the mines, there is never any lack of men ready and willing to go down the pit to try to rescue their entombed comrades This rescue worker has donned a breathing apparatus to combat the deadly afterdamp

Mining has been practised in many lands for centuries The Egyptians were the first miners, and the copper mines of Sinai, worked as early as 5000 B C, are the most ancient mines of which history makes mention Among the ancients mining was not regarded as honourable toil, and had to be performed by slaves, hence a nation had to become a conqueror before it could set up as a mine owner There still exist the tunnels, furnaces, crucibles, and parts of tools of some of the ancient miners

The work of utilizing the treasures of the earth's crust is hardly more than well begun The mining of the future will undoubtedly surpass anything we yet know, and the demand for competent mining engineers and specialists will increase steadily Such men are assured steady employment at good salaries, and success is likely to come earlier than in many other industries Mining engineering requires a broader scheme of study than any other engineering course The student is required to enter a recognized mining school, such as the Royal School of Mines in London

The Miners' Welfare Committee looks after the well-being of British miners, and is responsible for the erection of the splendid modern pit-head baths to be seen at several collieries British mining is under the Department of Mines, a branch of the Board of Trade (*See also under* Coal, Gold, etc)

Mink. This little carnivorous animal, valued for its fur, is related to the weasel, but is stouter in the body and has a bushier tail, more like the marten's The European mink, *Mustela lutreola*, is found in Poland, Finland, and Russia, is a little smaller than the American mink, *M vison*, which is 15 to 20 inches long, with a tail of 8 or 9 inches, and is more northerly in its range The Siberian mink, *M sibirica*, has fur of a clear tawny-brown colour The European mink and the American mink are yellowish-brown or dark-brown in colour, with a white spot on the chin and sometimes on the chest The darker the colour the more highly prized is the fur, a really fine genuine mink coat may cost hundreds of pounds



W S Berridge

THE VALUABLE MINK

One of the most important of all fur-bearing animals is the little mink, found in various parts of the world and now bred in large numbers for the fur trade Notice its fine, long coat and big tail, and its general resemblance to the weasel and stoat

The mink lives along the banks of streams and ponds, like the musk-rat, and hunts both in water and on land, by night or by day He is a great nest-robber, and also eats small animals, frogs, fish, lizards, grubs, etc He is equally agile on land, in the water, and up a tree

Minnesota, U S A Gold is precious, but iron is essential, and bread is indispensable The world's greatest flour market is Minneapolis, this State's largest city, some of the most productive wheat lands in the world lie in the Red River valley, which is partly in western Minnesota, and the most productive iron mines in the world are in the Mesabi range in the north-eastern corner of the State

Minnesota is bounded on the north by Canada, on the west by N and S Dakota, on the south by Iowa, and on the east by Wisconsin and Lake Superior There are some 10,000 lakes in Minnesota (from one of which, Itasca, the Mississippi rises), and there are enormous sources of water-power The surface of the State is mostly rolling prairie or timber forest, but in the east iron ore is obtained and flour mills are established Minneapolis (population, 464,000) and St Paul (the capital, population, 271,000) are the "Twin Cities" on the Mississippi If you were to visit Minneapolis and see its wonderful sky-line of flour mills, you would understand why it has long gloried in the title of "the world's miller" In some years these mills have ground 18,000,000 barrels of flour—nearly one-sixth of the output of the whole of the U S A Minneapolis is also one of the chief wheat markets, and its towering elevators can store more than 50,000,000 bushels of this grain Power from the St Anthony Falls of the Mississippi turns the wheels of the flour mills and was a chief factor in the city's industrial growth Duluth (101,000) is an important industrial centre and seaport on the shores of Lake Superior The area of Minnesota is 84,680 sq miles, and its population is 2,563,000

Mint, Royal The only establishment in the United Kingdom authorized to make metallic money is the Royal Mint, which stands on Tower Hill in London Prior to the foundation of the Royal Mint, the coins that were produced in London were minted in the Tower, and this had been the case ever since Roman times Now, however, our metal money is made in the Mint, and so, too, is the coinage of certain foreign countries and British colonies

Many years ago there was a mint in almost every county, and at one time the sovereign, barons and bishops had the right to coin money In the reign of William III all the county mints were abolished and special regulations were made by law whereby public authority to coin money could be exercised by one national mint Nowadays, if people try to evade the law by counterfeiting money, they are punished

We will trace the making of a shilling, from the time the silver arrives at the Mint from distant parts of the world until it passes into circulation as a coin of the realm When the bars of silver have been unloaded at the docks they are taken to the Mint yard, where they are wheeled on trolleys to the melting-house The rough metal has to be well guarded, for one trolley-load of silver is worth many thousands of pounds

Heaps of Silver in the Strong-room

First, the bars, or ingots, of metal are weighed, and then they are marked If they are not required for the melting-house they are stored in the strong-room A burglar would have very little chance of breaking into this room, for the door is of immense thickness, and it is closed by means of three ingeniously-contrived locks Two men only are entrusted with the secret whereby this door can be opened, and as a further precaution neither of the men can open the door without the aid of the other Besides being burglar-proof, the strong-room is also able to resist fire

The silver is melted in a closed furnace which has such an extremely high temperature that the metal soon becomes changed into a liquid The ingots are placed in crucibles, and after these are closed they are placed inside the furnace When melted, the pure molten metal is run into long narrow moulds, and, when cooled, it is in the form of thin bars

In turn the bars of silver are pressed through five presses, which roll them into the thickness of the required coin They are then cut up by a machine into the required size at the rate of several hundreds in a minute As the long metal bars are cut up they fall in a heap, and what remains is then remelted

If you examine a shilling closely you will see that the edge is slightly raised But for this the

coin would wear much more quickly. A very complicated machine is used to make a raised edge to the silver disk. In addition, the edge is "milled" to obviate any chance of dishonest people clipping or filing the coin.

The blank shillings now have to be well baked, and they are placed in small iron boxes which pass through a furnace on an endless chain. When the silver blanks have been thus treated, they are removed from the furnace and placed for cleaning in a copper containing boiling acid. They are next stamped between two dies. On one side (the "obverse" or "heads") is the King's head in profile, with a Latin inscription, and on the other side (the "reverse" or "tails") is the name of the coin, the year in which it was struck, another Latin inscription, and the figure of the British lion standing on a crown. The reverse of the new Scottish shilling is of different design, showing (as a mark of respect to the Queen) Scottish emblems.

Now comes the very important work of testing the coins. They are carried off to the testing-room, and a man places them on a slowly-moving belt, which passes before a "tester" who has a marvellous sense of touch. He touches every coin, and his fingers quickly tell him if any coins are imperfectly made. Those which he rejects are put aside to be remelted; the good ones move slowly along the belt to a tray into which they fall. They are then weighed, and taken to the counting-machine.

This counting-machine is quite the most wonderful machine in the building. It seems almost human; indeed, it is better than a human counter, for this machine is always absolutely accurate. It not only counts the shillings, but tests them, weighs them, and drops them into bags ready for circulation.

The bags are taken to the "circulating" room, and from here they go out into the busy world. Their adventures are numerous and varied, and the true autobiography of a coin would make absorbing reading. An interesting fact is that once a year sample coins are collected in a box and sent to the Goldsmiths' Company for weighing and assaying. This is known as the "trial of the pyx"—from the Greek word *pyxis*, meaning a box.

The old-time office of Master of the Mint, once a highly-paid and much-coveted position, is now filled by the Chancellor of the Exchequer, though his responsibility is, of course, purely nominal. The actual executive officer is the Deputy Master. (*See also* Money.)

Mint. The fragrant herb we call mint preserves the name of the beautiful nymph Mintha. The goddess Persephone, so the old Greek myth runs, in a fit of jealous rage turned her beautiful rival into the plant which is now so highly prized for its flavour and scent.

WILD PEPPERMINT

This is one of the commonest species of mint found growing wild in Britain, and it is easily recognized by its scent. Its general features—opposite leaves and spikes of pale purplish flowers—are common to most of the mint tribe.

Many kinds of mint exist. The most important of these are spearmint or garden mint, *Mentha spicata*, used in mint sauces and for flavouring chewing gum; peppermint, *M. piperita*, with which peppermint sweets are flavoured, and menthol is prepared; pennyroyal, *M. pulegium*, used in medicine; and bergamot, whose lemon-scented leaves give a fragrant oil much used in perfumes. These and other species are distributed all over the world. All have a creeping root-stock, square stems bearing opposite simple leaves, and small purple, white, or pink flowers in whorls that often form terminal spikes. The mints belong to the family *Labiatae*, which contains many other fragrant herbs such as sage, thyme, marjoram, lavender, and rosemary. Our commonest wild species is the water mint, *M. aquatica*.

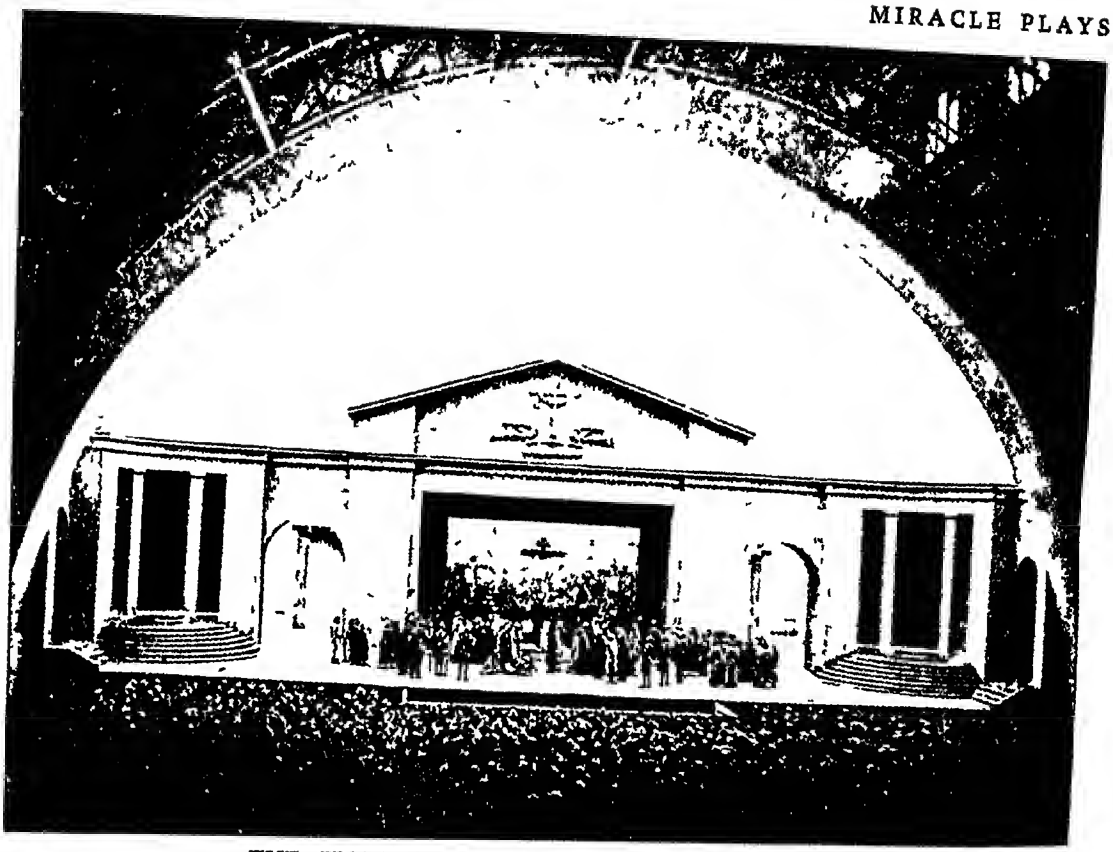
Catnip or catmint (*Nepeta cataria*), which is eaten by cats with such relish and which is often steeped to make a medicinal beverage, also belongs to this family.

Mirabeau, Count (Pron. mēr-ah bō) (1749–1791). To the nobles of France, in 1789, the brilliant but dissolute Honoré Gabriel Riqueti Mirabeau must have seemed a traitor to their class, for in the Estates-General of that year, to which he was elected, he acted as a leader of the Third Estate or common people. But Mirabeau had learned by personal experience something of the evils of the old government; and when the nobility refused to elect him as a

HOW MONEY IS MADE AT THE MINT

Fox

The photographs in this page illustrate five stages in the manufacture of money at the Royal Mint in London Top left, stamping the coins from a metal strip, top right, examining 12-sided threepenny pieces, centre left cleaning new coins, centre right, testing the "finished article", and finally on left, weighing newly-minted money in bulk.



THE WORLD'S MOST FAMOUS MIRACLE PLAY

At Oberammergau in Upper Bavaria, not far from Munich, there takes place the famous Passion Play, done by the villagers This actual picture shows the Crucifixion scene in the production of 1934, when the 300th anniversary of the Passion Play was celebrated As you can see, the play is now performed in a vast open-air theatre, with an arched roof over the spectators —a far cry from the simplicity that once marked the beautiful old drama

German Railways Bureau

representative, he turned to the Third Estate, so that he might not be prevented from helping in the changes so badly needed

Mirabeau's father, an eccentric nobleman, heartily disliked him because of his ugly face, scarred by smallpox, and the wild life of his youth Several times the father had secured from the king orders for the imprisonment of his wayward son, possibly to keep him out of mischief, and one of Mirabeau's first writings was against these arrests by *lettres de cachet*

In the Estates-General Mirabeau first attracted attention by openly defying the king Louis XVI had sent a command to the members of the Third Estate to retire from the hall in which they were sitting to their old separate place of meeting But Mirabeau replied to the messenger "Go tell your master that we are here by the will of the people, and that we shall be removed only at the point of the bayonet" From this time his influence in the assembly was great His fire and dash and his stirring words won for him the titles of the "Tribune of the People" and the "French Demosthenes"

His statesmanship, however, saw clearly the dangerous direction in which the Revolution was going In order to save the country from impending disasters, he undertook secretly to advise the king with counsels of moderation But the king and queen detested Mirabeau because of his former life and because he took money for his advice, and they refused to be guided by his counsels Thus his attempt to establish a constitutional monarchy, such as England had, failed He was elected president of the famous Jacobin Club in 1790, and, shortly afterwards, of the National Assembly

Worn out by his work and weakened by his dissipations, Mirabeau died, April 2, 1791 His death removed the one statesman who could have guided the Revolution through the coming troublous times, a fact which Mirabeau clearly recognized when he exclaimed just before his death "I carry with me the ruin of the French monarchy" (*See* illustration p 1756)

Miracle Plays. In the Roman Catholic Church the celebration of the Mass and the special services for the festivals have many dramatic elements In the Middle Ages these services were made more popular and more instructive by the use of living pictures, or tableaux—as, for instance, the representation of the Child in the Manger with the Wise Men

It was a natural step from tableau to acting, first in dumb show, and then with appropriate

songs and dialogues This was the origin of the "mysteries" and "miracle plays" As far back as the 10th century we find simple plays of this kind, though the earliest play mentioned by the name is the "Play of St Katherine," produced in England in the 12th century

At first the language used was Latin, but later this was changed to the language of the people—English or French or German, as the case might be As the plays grew in length and elaborateness, they were transferred from the church to the churchyard, and then to the village streets Once outside the church, secular and comic elements were added In the 13th century these plays came little by little to be taken from the hands of the clergy, and by the latter part of the 14th century they were acted almost entirely by the different guilds, or unions, of craftsmen These companies went from town to town with large wagons, called "pageants," on which they set up a stage with rude scenery

Mystery Plays from the Bible

The Creation, Noah and the Flood, Adam and Eve, Abraham and Isaac, and other stories of the Old Testament were presented, as well as incidents in the life of Christ Strictly speaking, these representations of stories from the Bible were the "mysteries," while the miracle plays dealt with the lives of the saints, but this distinction was not always observed Closely associated with these plays were the "moralities," in which moral lessons were taught by representing virtues and vices as persons

Most of these plays, which originated as a means of religious and moral instruction, became so corrupted by jests and vulgarities that they were condemned by the Church, and after the 15th century they almost ceased to be given But the pure type of "mystery" is still preserved in the beautiful Passion Plays, the most famous of which is presented periodically at Oberammergau, Bavaria (*See* Drama)

Mirage. (Pron mĕr′-azh) Travellers over burning desert sands sometimes think they are nearing an oasis because they see in the distance green palms growing about cool water But the vision fades before their eyes, for it is only a reflection, or air picture, of an oasis far away below the horizon This is a mirage

To understand the cause of a mirage it must be remembered that we see an object by rays of light reflected from it to our eyes, and in the straight line in which the rays enter the eye Ordinarily these rays come to the eye in straight lines from the object and we see only objects above our horizon

Now, in the case of a desert mirage the rays of light passing upward from an object below the horizon are reflected back from a layer of denser air above the hot light air next the sand This higher layer of dense air acts as a mirror and, as it is above the object it reflects, this object appears above the horizon and in the sight range of the traveller, when in reality the place seen in the reflection is miles away and out of sight The air layers vary in density and sometimes reflect a double image, one upside down

In the ocean mirage a vessel below the horizon is plainly reflected in the upper air A most remarkable ocean mirage was seen in 1854 on the Baltic, when the English fleet appeared to be floating in the air The case of the ocean

THE HEART-BREAKING MIRAGE OF THE DESERT

Who has not heard of thirst-maddened travellers in the Sahara suddenly seeing a tempting vision of a cool oasis which vanishes at their approach? Usually the mirage is accompanied by an inverted duplicate, which looks as though it were mirrored in the sand Desert mirages are the reverse of ocean mirages, being caused by the reflection from a layer of cool air above the hot surface air

mirage, which occurs in the cold northern waters, is just the opposite of the desert mirage, for the cool dense air is close to the water and the reflection is caused by a warmer layer of air above it

Still another form of mirage is known as "looming" In this the objects are seen magnified and sometimes, when the sun is just in the right position and the sea and the air help, are set against a background of coloured mists This form of mirage is common in the Straits of Messina People in Reggio, looking towards Sicily, may see castles, trees, and men suspended above the sea This vision is a reflection of the city of Messina, though for long years it was thought to be a city of fairy castles and so was given the name "Fata Morgana," the fairy known in English legend as Morgan le Fay

Mirrors. In prehistoric times the only mirrors were pools or lakes Later highly-polished metal mirrors were made, such as the bronze mirrors of the Egyptians, Greeks, and Romans, and the mirrors of the modern Japanese Similar to these were the unbreakable "trench mirrors" used in the World War Not until the 13th century were mirrors of glass with backs of lead or tin manufactured

In the 17th century the Venetians made a vast improvement by mixing mercury with the tin for the reflecting surface Although the mercury fumes killed many workmen, and weeks were required to complete a mirror, the method was in common use until about 1855, when the modern process of backing mirrors with nitrate of silver was patented The mercury process is still occasionally used for cheaper mirrors

Today a mirror of any size can be made in about an hour For the best mirrors, plate-glass about a quarter of an inch thick is used This is cut to the proper size with a diamond-pointed instrument Then it is bevelled with sand and water in a 'roughing mill,' polished on emery wheels and smoothed with the sandstone and buffers of thick felt covered with rouge

Next, in the silvering department, it is cleansed and placed on heated and blanketed tables A diluted compound of nitrate of silver, ammonia, and tartaric acid is poured over it, the heat from the table helping the silver to adhere to the glass The silver back is dried, and then varnished or painted Silvered mirrors reflect 20 to 25 per cent more light than those backed with mercury

In the ordinary flat-surface or plane mirror, your image appears erect, and as far behind the mirror as you are in front of it But for scientific and other purposes curved mirrors are often made—convex, concave, etc Curved mirrors reflect distorted images, and so are often seen in amusement halls When you look into a concave cylindrical mirror you see yourself as very tall and lean, while a convex mirror makes you look absurdly short and fat Huge concave mirrors are often used in astronomical telescopes, and often many years may be spent in grinding and polishing their surfaces Some are made from glass, silvered on the front surface, and others are made of an alloy known as speculum metal (*See also* Glass)

SEEING SHIPS SAILING THROUGH THE CLOUDS

Why do we sometimes see mirages of huge ghostly ships sailing across the sky? The question puzzled men for centuries, but now we have an answer Somewhere above the ship is a layer of heated air The lower side of this layer acts as a mirror and reflects the image of the ship below, so that the light rays seem to be coming from somewhere in the sky If there are several layers, more than one image may be produced

The MIGHTY "FATHER *of* WATERS"

A VIEW OF THE MISSISSIPPI AS IT WINDS THROUGH MINNESOTA

Mississippi. The river Mississippi, the "Father of Waters," is the greatest river in North America and one of the largest in the world. Its basin embraces two fifths of the United States. The greater part of this vast region is very fertile, a fact which, combined with the latitude, elevation, and rainfall, makes the Mississippi valley an ideal dwelling-place for Man. Sixty million people dwell in the states drained by this mighty river.

Early Spanish explorers saw the mouth of this great river and named it the "River of the Holy Ghost." But Fernando de Soto is usually considered its discoverer, for he not only encountered its wide and muddy stream in his explorations in 1541, but died upon its banks and was buried in it. More than a hundred years passed before other white men saw it, when, in 1673, the brave and determined Frenchmen, Marquette and Joliet, descended it as far as the mouth of the river Arkansas. It remained for La Salle and his party, in 1681, to follow it to the Gulf of Mexico. A few years later Louis Hennepin, sent by La Salle, explored the upper river from the mouth of the Illinois to the Falls of St. Anthony. Not until 1832 did Henry Schoolcraft follow the Mississippi proper to its source in Lake Itasca in Minnesota.

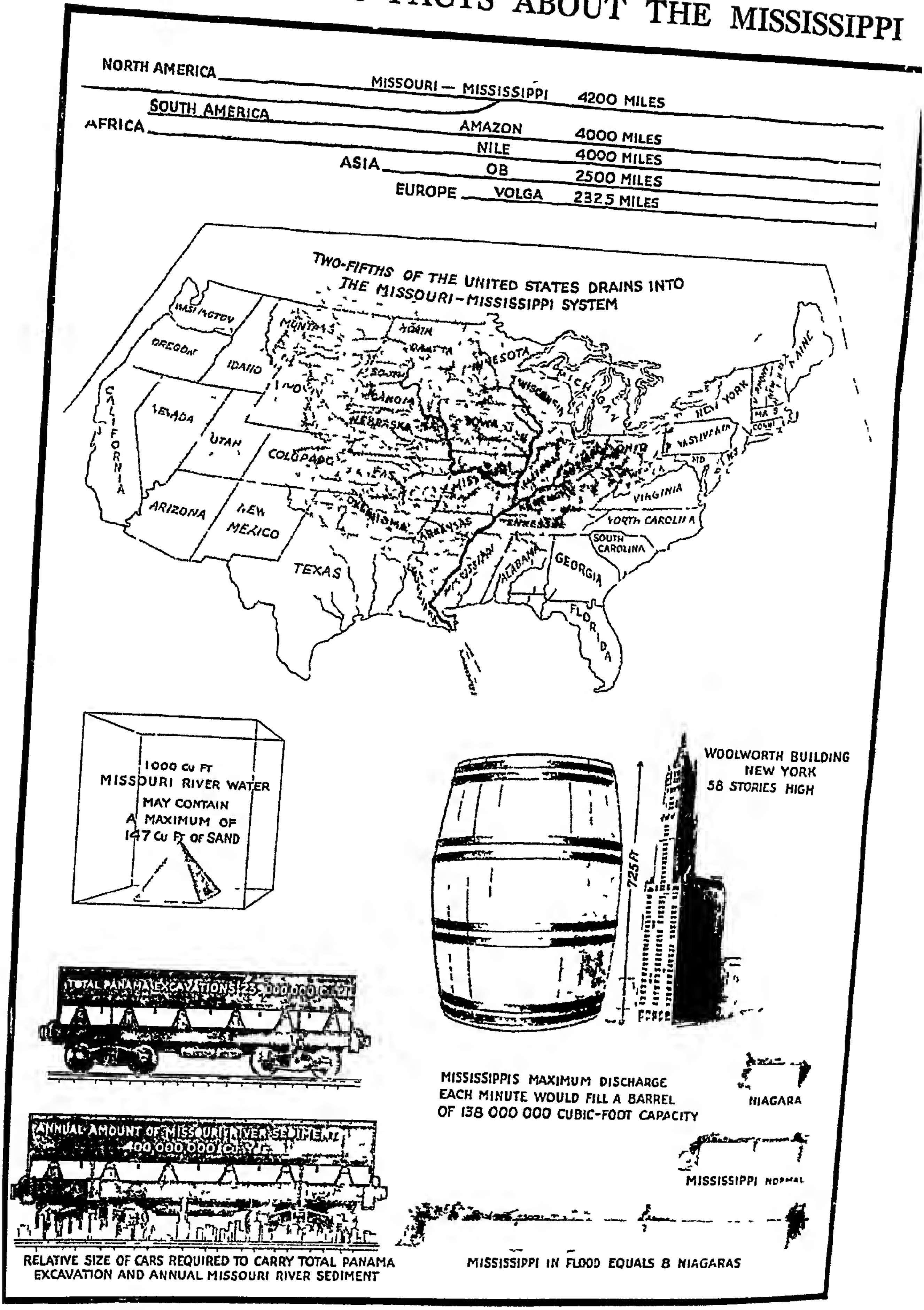
As it issues from the cool clear waters of Lake Itasca (the usually accepted source) the Mississippi is only a little stream 10 or 12 feet wide and about 2 feet deep. For a time it rushes north, and after much twisting and turning it settles into its south easterly flow. Tributaries join it, until it reaches a width of 1,200 feet at the Falls of St. Anthony. Here the river descends about 65 feet in three quarters of a mile, forming rapids. The banks of the stream presently rise in rocky bluffs, sometimes as high as 500 feet, and continuing almost to the junction of the river Ohio. At Cape Girardeau, 38 miles above the mouth of the Ohio, the bluffs cease and the great alluvial valley, which the river has built, begins.

World's Longest River System

Altogether there are in the Mississippi system 250 tributaries and their branches, making 14,000 miles of navigable water and a drainage basin of 1,240,050 square miles. The Mississippi itself is 2,486 miles in length, and, with the Missouri, 4,200 miles. In its lower courses it flows in great bends and curves, in one instance taking 1,300 miles to cover a distance of 675 miles "as the crow flies." There are great variations in the river's width and depth. At the junction of the Illinois it is just over a quarter of a mile wide, and after the Missouri flows into it the ordinary width is sometimes nearly a mile and a half.

Floods occur on the Mississippi almost every year, usually in the spring when melting snows and spring rains swell the tributaries and the waters come down in a great torrent, which brings disaster to vast stretches of lowland along its lower course. In the great flood of 1937 more than 300 lives were lost and nearly

SOME AMAZING FACTS ABOUT THE MISSISSIPPI



1,000,000 people were driven from their homes, and damage loss in four States alone amounted to £105,400,000

From Cairo (at the junction with the Ohio) to the sea the river is confined within a levee or embankment system, the most extensive work of its kind in the world There are about 2,000 miles in the present system, of which all but 70 miles have been constructed since 1905 The first levee was built at New Orleans early in the 18th century, to protect the new little settlement from destruction by the overflowing of the river

Among the chief cities along the banks of the Mississippi are Minneapolis, St Paul, St Louis —18 miles from the branching off to the west of the Missouri (*q v*)—Cairo, Memphis, Baton Rouge, and New Orleans

The State of Mississippi lies to the east of the river near its mouth It has an area of 46,865 square miles and a population of 2,000,000, half of whom are negroes A large quantity of cotton, maize, sugar, and fruit is grown, and forest resources are great Jackson (population 48,000) is the State capital

Missouri, U S A

From its source in the Rocky Mountains in south-west Montana, U S A, to its confluence with the Mississippi above St Louis, the mighty river Missouri ("Big Mud River") winds through a distance of 2,945 miles, while to the Gulf of Mexico the Missouri Mississippi is 4,200 miles long

Rising in the confluence of the Jefferson, Madison, and Gallatin rivers, the Missouri dashes almost due north through a beautiful mountainous region Sixteen miles east of Helena, Montana, it flows through a narrow canyon or gorge, with walls 1,200 feet high, called the Gates of the Rocky Mountains, where the beauty and grandeur of the scenery are almost unequalled Farther along, about 350 miles from its source, are the Great Falls of the Missouri, where the river descends nearly 400 feet in 16 miles, by a series of four cataracts, the highest of which has a fall of 90 feet It flows westward and then southwestward, and at Kansas City it flows eastward until it reaches the Mississippi With its tributaries it drains an area of over 500,000 square miles

Marquette and Joliet were the first explorers to discover the mouth of the Missouri, as they came down the Mississippi in 1673, but it was not till 1819 that the first steamboat was seen on the river

The Mississippi forms the eastern boundary of the State of Missouri (area 69,420 square miles, population 3,629,000), and the Missouri flows westward from near St Louis (population 821,000), the largest city in the State The surface of the latter is mountainous away from the river basin, with the Ozark Mountains in the south-west Maize is the chief agricultural product, and cotton, tobacco, and fruit are also grown Trade in live-stock is large Missouri is, in addition, a manufacturing State, with its industries centred in St Louis and Kansas City (399,700) The latter, which stands on the Missouri opposite the city of similar name in the State of Kansas, is an important railway junction and distributing centre Jefferson City (21,000) is the capital

H Bastin

MISTLETOE LEAVES AND BERRIES

One of the most remarkable of all parasitic plants, the mistletoe is as strange in appearance as it is in behaviour Here are its leaves and the curious waxy berries, which have such an attraction for birds that one, the missel thrush, is actually named after them

Mistletoe.

Do you know that this familiar Christmas decoration, with its waxen white berries and glossy evergreen leaves, never takes root in the ground, but is a parasite that grows from a "sucker root" on the trunks of other trees? It belongs to a genus of which there are about twenty species, all parasitic Of these only the mistletoe proper (*Viscum album*) is a native of Europe

Plentiful on Apple, Rare on Oak

The mistletoe appears as a bushy growth with many forking branches, often 4 feet long It has oval leaves and tiny yellow blossoms, followed by the little white berries that ripen after snow falls It grows on both deciduous and evergreen trees, in England in greatest abundance on the apple tree It is rarely found on the oak The birds eat the pulpy berries

Flying from tree to tree, they carry the seeds, which lodge in the bark and grow

Because of its peculiar character the mistletoe played a prominent part in German and Norse mythology, and it was with an arrow from its wood that the beautiful god Balder was slain The mistletoe was said to bring happiness, safety, and good fortune so long as it did not

touch the ground Perhaps this is the reason why today we always hang up our mistletoe The Celts held the plant in veneration, especially when found on the oak

Mistletoe is supposed to have been the "Golden Bough" which played so great a part in the strange rite attached to Diana's temple at Lake Nemi, near Rome (*See* page 1749)

'TOYS' *that* HELP *the* INVENTOR

When we talk of models we probably think of the toy trains and ships which both father and son love to play with. But some models, as we shall see, are not toys but exceedingly useful pieces of mechanism

Models. Probably no toys are so universally appreciated by both young and old as models Amongst the most primitive and the most civilized peoples you will find that these are the playthings of children, and in all ranks of society, too, they attract the attention of grown-ups After all, dolls are little more than models of ourselves, and from them, through the whole range of mechanical models, the same principle holds, a replica in miniature of some well-known object

The simpler models are toys for the youngest children, and it is when we grow a little older, and begin to go to school, that they become important At most schools there are model-making clubs, and competitions for models of various kinds Most of us seem to lose our interest all too soon, but quite a number of people carry their love of models all through life Thus, there are model yacht clubs almost wherever there is water to sail the yachts, model railways occupy the spare time of many great men in all parts of the world, model aeroplane clubs are equally popular, there are rules for the racing of model racing-cars, and the actual construction of these many types of models occupies as much time as playing with them

Models Made to Scale

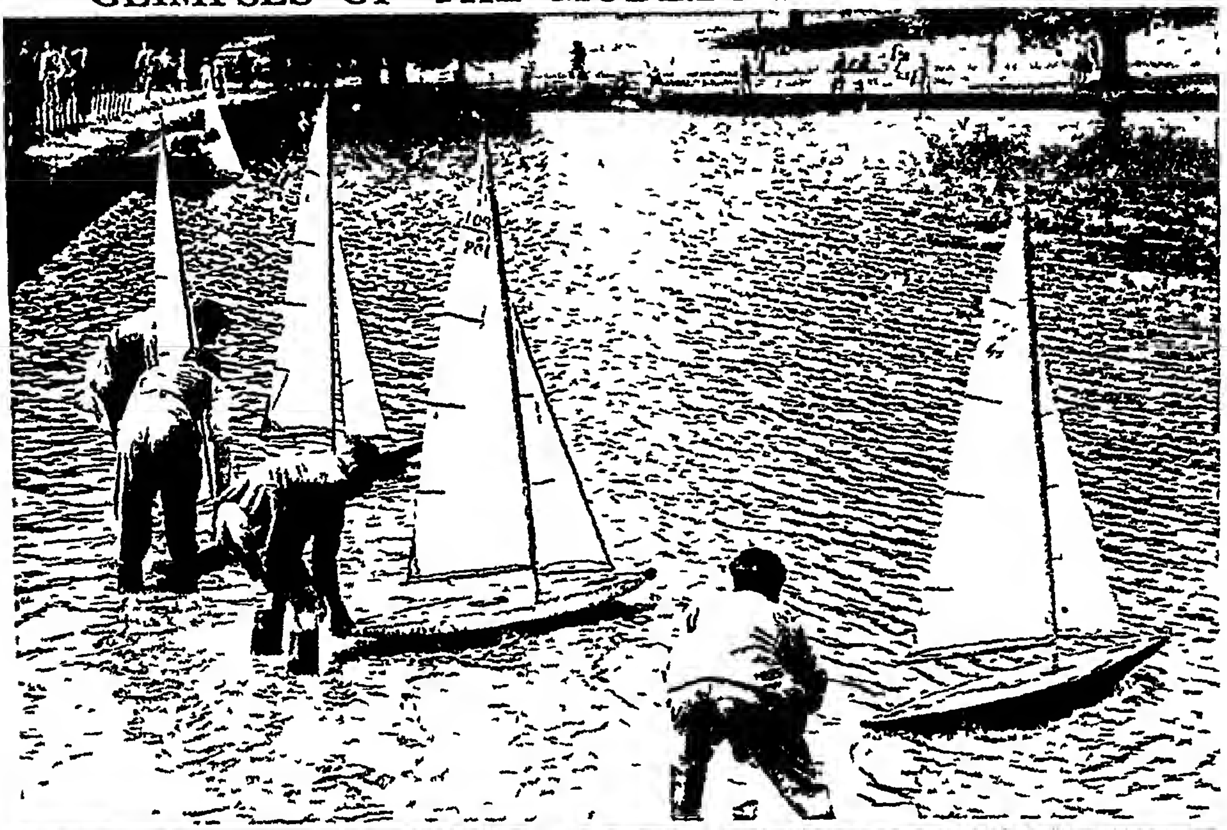
Models, however, are by no means always playthings Most inventors make models of their work *before* producing the actual object These are true scale-models, in which every part is built in its correct proportions, so that the final result is an exact copy in miniature of the invention The opposite of this, incidentally, is seen in most aeroplane models which are made to fly, for, since the power that works a model aeroplane is so different from that in a real one, the models must be made to suit the changed conditions Model aeroplanes built to fly, therefore, are quite different in design from those which reproduce actual machines The same applies to many model ships, which, indeed, are divided into two types the "sailor's model" is one made by a sailor, and reproduces the ship as he knows it, the "builder's model" is a scale-model, which shows you what the ship was really like

Among the first inventors to make models of his work was James Watt, who did much of his most important work on model steam-engines of various types In the same way, Otto Lilienthal, the famous German gliding pilot of the 'nineties, made several models before he tried to build a full-scale glider

Testing for Wind Resistance

But nowadays models are used for all sorts of purposes Aeroplanes and locomotives are made as scale-models, and can be exhaustively tested in a wind-tunnel, so that the designer knows accurately just what they will do when they are flown or run for the first time Similarly, too, big ships like the Queen Mary are first tested in tanks in which their designers can discover how they will behave under certain conditions of sea and tide How important this may be was shown during the races for the America's Cup in 1937 When the English Endeavour II was so easily defeated by the American boat Ranger it was considered that the latter's superior design was almost entirely due to the fact that exhaustive tests with models had been made before she was built In the same way, also, the motor-cars in which tremendous speeds are made, such as those designed to attack the world's speed records are all made first as models, and very carefully tested in wind-tunnels to make sure that their stream lining approaches the ideal Then a shipping company may make a model for publicity purposes—to show the public the features of their ship in miniature Architects make scale models to help in the consideration of design,

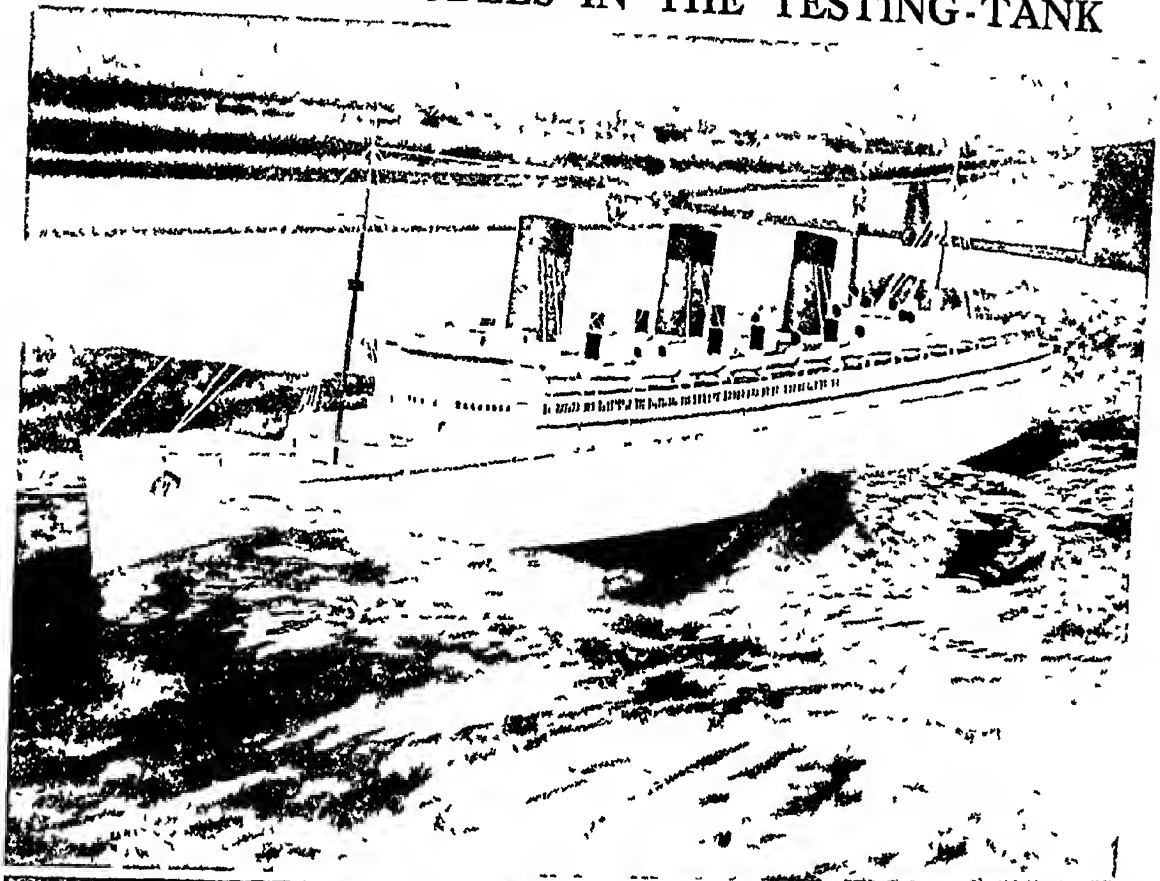
GLIMPSES OF THE MODEL-MAKERS' WORLD

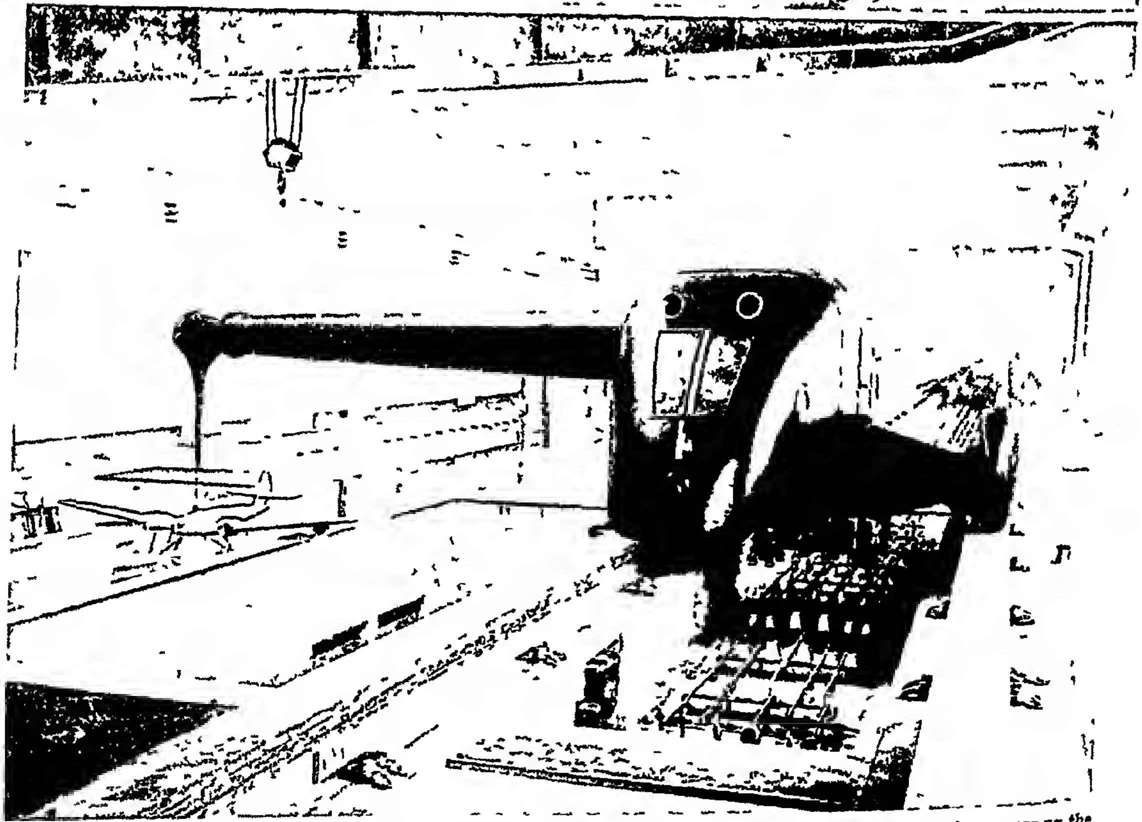


L. N. A. Fox

Model yachtsmen delight in trying out their craft—the construction of which is often entirely their own work—in organized racing, and we see (top) the start of the race for "ten-raters" at the Highgate Model Yacht Club. The lower picture shows a scene in the famous model town of Bekonscot, built by R. R. Callingham at Beaconsfield in Buckinghamshire. In addition to the houses, shops, roads and railways seen here, this unique masterpiece of model-making includes a miniature lake, gardens, a country club, docks, airport, roadhouse, church and convalescent home

SCIENTIFIC MODELS IN THE TESTING-TANK



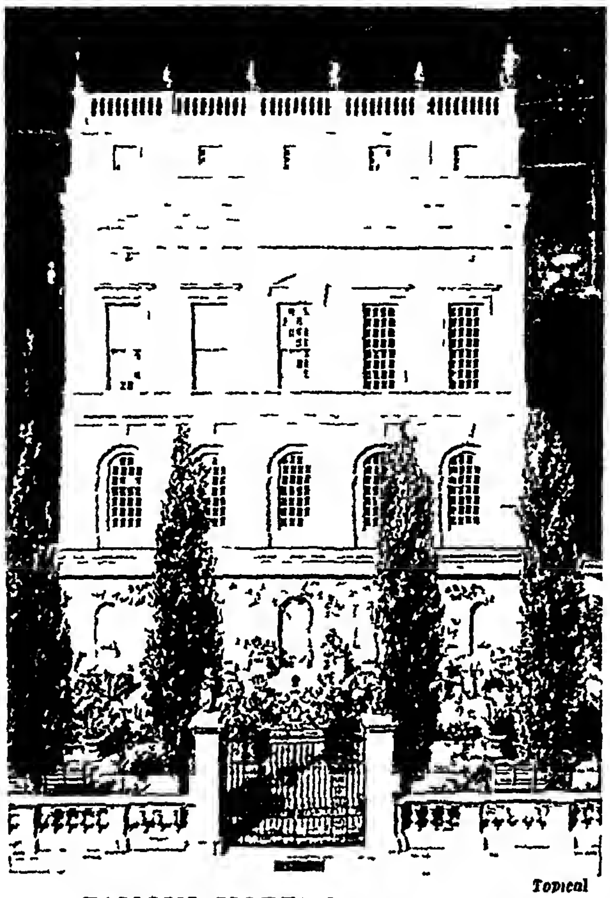


One of the most practical uses of models is in determining the relative merits of various scientific designs by comparing the behaviour of scale-models under artificially-produced conditions Above, for instance, is an 18-foot model of the great liner Queen Mary riding a gale produced by special wave-making apparatus in the experimental tank The lower photograph shows the seaplane testing-tank at Guidonia, Italy's aeronautical research station The actual flying qualities of aircraft are often the subject of exhaustive tests with models in the "wind-tunnel" type of apparatus

Photos top courtesy of John Brown & Co Ltd and lower G P A

lawyers produce models to prove a case in the Courts, and so on Historical models, such as the Queen's Doll's House (now in Windsor Castle), are often marvels of accuracy and detail

To see really fine collections of such models, you should visit some of the museums, but especially the Science Museum in South Kensington, London For there the makers of all sorts of things send their official models when they have finished with them, so that you see the very best models there are Many fine models, too, are made in the museum itself, while there is a huge collection of those constructed by famous inventors of the past, showing the originals from which have come many of the most important creations of the modern world If one is seriously interested in models, it is worth while to join a model-making club, for there one can indulge one's hobby in company with fellow enthusiasts of all ages


Topical

FAMOUS MODEL DOLL'S HOUSE

Perhaps the finest of all model houses this was designed by Sir Edwin Lutyens and presented to Queen Mary In style it is an adaptation of Georgian It is shown here as it appeared at the Wembley Exhibition in 1924

Mole. Destined to spend his whole life in darkness, digging, digging, digging, in order to build his home and to obtain the food necessary for his existence, a queer little creature, scarcely able to see or hear, and yet marvellously adapted for the part Nature has designed him to play in the world—the common mole is one of the most interesting of all animals

You can always see where the mole has been by the long ridge of cracked earth that zigzags across fields—the roof of his tunnel, but it is lively work to dig him out, for he may be at either end, anywhere along the route, or in a side chamber, and he can dig as quickly as you can, if not quicker

If you put the sprawly wriggly creature on the ground, he scrambles about frantically until he finds a soft spot Then he begins to dig with his strong, spade-like fore feet, and in less than one minute the animal has disappeared into a burrow in the ground The swiftness with which a mole works is almost incredible, in a single night one has been known to tunnel nearly 100 yards

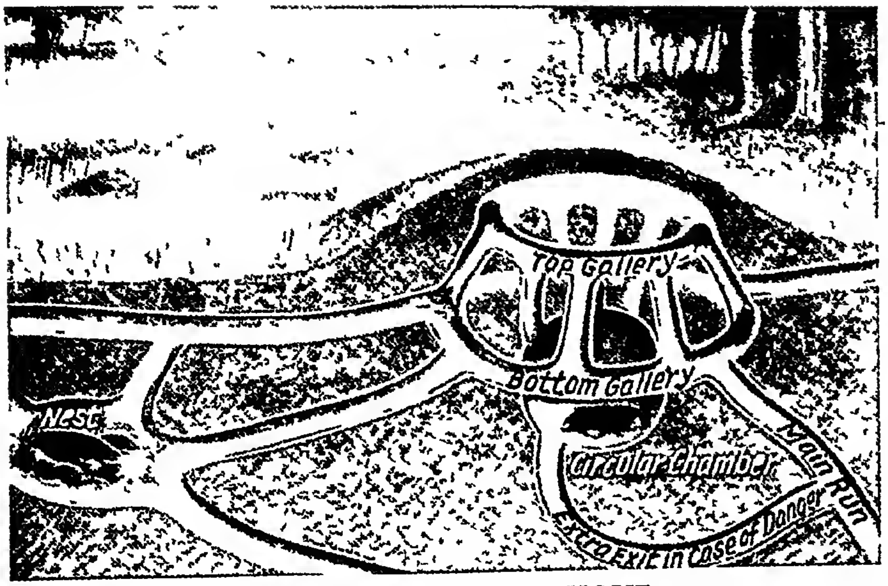
Moles are found in both the Old and New Worlds in the Northern Hemisphere The common mole disfigures lawns, pastures, and gardens extensively by the ridges and furrows it makes hunting after food, but as it feeds on injurious larvae and insects, it compensates for the damage Moles are among the most voracious of all animals, eating earthworms in quantities, and occasionally field-mice In former times every district had its local mole-catcher, but now systematic trapping by farmers has put this functionary out of business

The mole ordinarily lives in a series of burrows, throwing up the soil into the familiar mole-hill But it breeds in quite a complicated fortress In this is constructed a central chamber surrounded by two ring-like galleries, one above the other These circular galleries are connected by vertical passages, and the upper one has


S Crook

MOLE ABOVE GROUND

If you should find a mole above ground in the early morning, you will have a chance to note the strong little digging "hands,' the sharp nose, and the close fur of the queer little animal that makes mole-hills on your lawn



PLAN OF THE MOLE'S HOME

In this plan you see the features that may be found n mole-hills, although no one hill will have all of them, nor will it be quite so complicated or well-designed Often it is as simple as the "nest" you see on the left, and the design is accidental, not deliberate

openings into the central cavity From the lower gallery a series of about nine alleys lead off in different directions towards the feeding-grounds

The common mole, *Talpa europaea*, is about 6 inches long, with a sharp snout, strong spade-like feet, tiny ears, eyes, and tail He is not blind In the tropics are some very strange moles, such as the star-nosed mole of America and the golden mole of the Cape Moleskin is often used for waistcoats

Molière. (Pron mō'-lyār) (JEAN-BAPTISTE POQUELIN) (1622–1673) What Shakespeare was to English literature, the great comic dramatist Molière was to France Molière belongs, like Shakespeare, to all lands and all ages

Jean-Baptiste Poquelin—for that was his real name—was born in Paris, the son of a prosperous furniture-maker, who held the office of upholsterer to the king The young man chose the uncertain life of a strolling player, and it was at that time that he took the stage name Molière As an actor and theatrical manager, he learned the art of the stage, and gained that perfect mastery of dramatic structure for which his plays are noted He also learned to know human nature, and especially he searched out men's vanities and follies

He usually emphasizes one outstanding characteristic Harpagon in "L'Avare" (The Miser), and the hypocritical Tartuffe are immortal creations of his genius, and few characters have aroused the world's laughter so much as Monsieur Jourdain in his comedy "Le Bourgeois Gentilhomme"

Molière's last play was "Le Malade imaginaire" (The Imaginary Invalid), and in this he himself played the leading part, that of Argan Though the character was suffering only from an imaginary disease, the actor himself was really very ill In the midst of the play he fell into a violent fit of coughing, and died half an hour after the performance It was Molière's last jest

Molière's chief plays are "Les Précieuses Ridicules" (The Ridiculous Blue-stockings), 1659, "Tartuffe," 1664, "Le Misanthrope" (The Hater of Mankind), 1666, "Le Médecin Malgré Lui" (The Physician in spite of himself), 1666, "L'Avare (The Miser), 1668, "Le Bourgeois Gentilhomme" (The Tradesman turned Gentleman), 1670, "Les Femmes Savantes" (The Learned Ladies), 1672, and "Le Malade Imaginaire," 1673 (*See* illustration page 1737)

Molluscs. The large group (or phylum) of animals called molluscs, or *Mollusca*, comprises all those creatures which we know usually as "shellfish" Most molluscs are provided with hard, limy, or "chitinous" shells, which are either carried on the outside or are partially or wholly enclosed by a sheet of shell-forming muscular tissue, called the "mantle" They

MOLIÈRE WRITING A PLAY

One of the greatest of French playwrights, Molière is famous for his comedies, which do not "date" but are still as delightful and as popular as when they were written nearly three hundred years ago

live on land and in water, both fresh and salt There are four principal groups or classes

(1) *Cephalopods* —The most highly organized of all molluscs are the Cephalopods, or "head-footed" molluscs, which are so called from the fact that the head is surrounded by a circle of eight or ten sucker-bearing tentacles In some ways the cephalopods approach in intelligence and in complexity of structure the vertebrates, or animals with a backbone They have often been the subject of poem and story, and the beauty of colouring in some forms is so striking as to merit the attention of the artist as well

Only Survivor with a Shell

Cephalopods include the nautilus, the argonaut, the octopus, the cuttle-fish, and the squid The nautilus is the only member of the group now living which carries an external skeleton or shell But long before human history began—millions and millions of years ago—there were many shelled cephalopods in the sea, all of which, except the nautilus, became extinct They included many forms with all sorts of curious shells, as well as the whole group, so well known as fossils, of the Ammonites (*q v*)

All other cephalopods which have survived and become large possess either a small internal skeleton or no skeleton at all The shell of the beautiful paper nautilus, or argonaut, is not a skeleton at all, but a mere case used by the female for the protection of her eggs

(2) *Lamellibranchia* —This second group of molluscs is given its name because the gills (*branchia*) are composed of a series of flat, leaf-like plates (*lamellae*) The animals in this group have a "foot" shaped like a stone axe, which serves as a burrowing organ, and from this they are sometimes called *Pelecypods* or "hatchet-footed" molluscs, and, finally, they are popularly known as "bivalves" because the shell has two equal valves or parts This group includes the oyster, the cockle, the mussel, and the scallop The body is enclosed by the two lobes of the mantle, and in turn is covered by the two valves

This group of molluscs supplies Man with a large amount of food as well as with other articles Oysters, clams, and mussels are collected in enormous quantities in many parts of the world, and used as a substitute for meat, the shells of fresh-water mussels are manufactured into buttons Pearls of fine quality have also been found in many kinds of mussels, as well as in the oysters of the sea, which are therefore the subject of a double fishery, and the inside of their shells provides the lovely "mother of pearl" Mussels are also of service as scavengers, for they devour decaying organic substances in lakes and streams

(3) *Gastropods* —These "stomach-footed" molluscs, which form the third group, are typified by the snail and the whelk They have a distinct head, which bears one or two pairs of sense organs—the tentacles, or "horns" The two eyes are placed on the tentacles When there are two pairs of tentacles, the eyes are placed on the hind pair The foot forms a creeping disk, on top of which is a twisted hump, covered by the mantle, and containing the digestive organs

When at rest the animal is entirely covered by its shell, the form of which is determined by the hump If this is twisted or coiled, the shell also is twisted In some forms, as in the limpet, the shell is a simple cone Many of the gastropods, like the periwinkle, close the mouth of the shell on retiring into it with a trap door, and even the land snails secrete a partition across when they meet with adverse conditions The gastropods are found throughout the world, and furnish more than half of the 65,000 known species of living molluscs Some forms have lost their shells more or less completely, and these you know by another name—slugs

(4) *Amphineura* —A fourth group, called *Amphineura* because of the doubling of their nerve cords, contains the chitons, which are molluscs with a small shell formed only on the upper surface and consisting of a number of overlapping plates In these species the body is usually oval, and there is no distinct head The feet constitute the entire lower part of the body (*See also* Cockles and Mussels, Cuttle-fish Oyster, Scallop, Shell, Snails and Slugs)

Monaghan, Co of Eire This inland agricultural county of Eire lies within the ancient province of Ulster, and the border or frontier customs line between Northern Ireland and Eire marks the limit of its northern and north-western boundaries

Monaghan covers some 500 square miles and supports a population, largely agricultural, of just over 61,000

Lying partly in the great central plain to the north west, the county is rugged and barren in the south and east Oats, potatoes, and flax are the main crops, while cattle, sheep, pigs, goats, and poultry comprise its increasing live stock industry There are few manufactures, the chief being linen and lace, the town of Carrickmacross giving its name to a special type of lace which has been manufactured there since 1820 Limestone, freestone, and slates, all lying near the surface, are cheaply quarried in considerable quantities

The county town is Monaghan (population 3,000), it boasts a magnificent modern Catholic cathedral standing on a hill just outside the town Clones (population 2,000), besides being a busy market centre, has both historic and archaeological interest

The USE *of* MONEY *in the* WORLD TODAY

As we jingle the coins in our pockets we hardly realize that the invention of money was one of the most important events in history. If you doubt it, try to imagine a world in which money has no place.

Money. Money serves several purposes in our economic life It is the yard-stick by which we measure the values of goods and services It is the medium by means of which we make nearly all our exchanges It also serves as a convenient way to store up purchasing power for later use


Bags of Money!

As a measuring device, money is almost indispensable in our economic society, with production organized as it now is Let us take a few examples

Suppose a certain family has an income of £50 a month It is spending £15 for rent and dividing the balance among food, clothing, light, heat, savings, and miscellaneous expenses At every turn it measures the cost of one desired article against another, and the cost of all desired articles against the total family income The family often considers whether it should move into a better house at £20 or £25 a month and cut down other expenses On one occasion it decided to spend £30 on furniture Many articles were desired, but most of all a wireless set and an Oriental rug A shopping tour showed that the Oriental rug would take all of the £30 But a satisfactory domestic rug could be bought for £12, leaving enough to buy a wireless set and several of the other articles desired

Such experiences illustrate the use of money as a *measuring device* The family is able to compare the cost of shelter, a rug, a wireless, and other articles because it can express these costs in terms of a common denominator—that is, a money unit It can also compare its total wealth and its total monthly income with the cost of things that are desired, because all of these can be expressed in a common unit That common unit is for us the pound sterling

When we think of money in this way we are thinking of it as a *unit of measurement* It is like a foot-rule, or a yard-stick, or a pound weight While it would be possible to express the comparative lengths of two poles or the relative values of wireless sets and rugs in terms one of the other, it is far more convenient to use a standard measuring unit in terms of which each may be expressed

Now for an illustration of a second use of money Suppose I have a cart-horse which I no longer need I desire a horse for riding I may search for a man who has a hack and who wants a cart-horse of equal value If I find him an exchange may be made But it is far simpler to work through a medium—*i e*, to sell my cart horse for money and with the money buy a hack Thus I may bring about the exchange, even though the man who has the hack does not want a cart-horse, or if the two are of very different values In other words, *by having some common medium which everyone will accept, trading or exchange is made easy* When some type of article or commodity will be generally given in return for goods or services and will be generally accepted as payment for goods and services, that type of article or commodity is serving as money in the sense that money is a medium of exchange A government may declare that a certain commodity, or representatives or *tokens* of it (such as pennies and halfpennies), shall be taken as payment for debts A government thus makes such money *legal tender*

'Part Exchange' is Barter

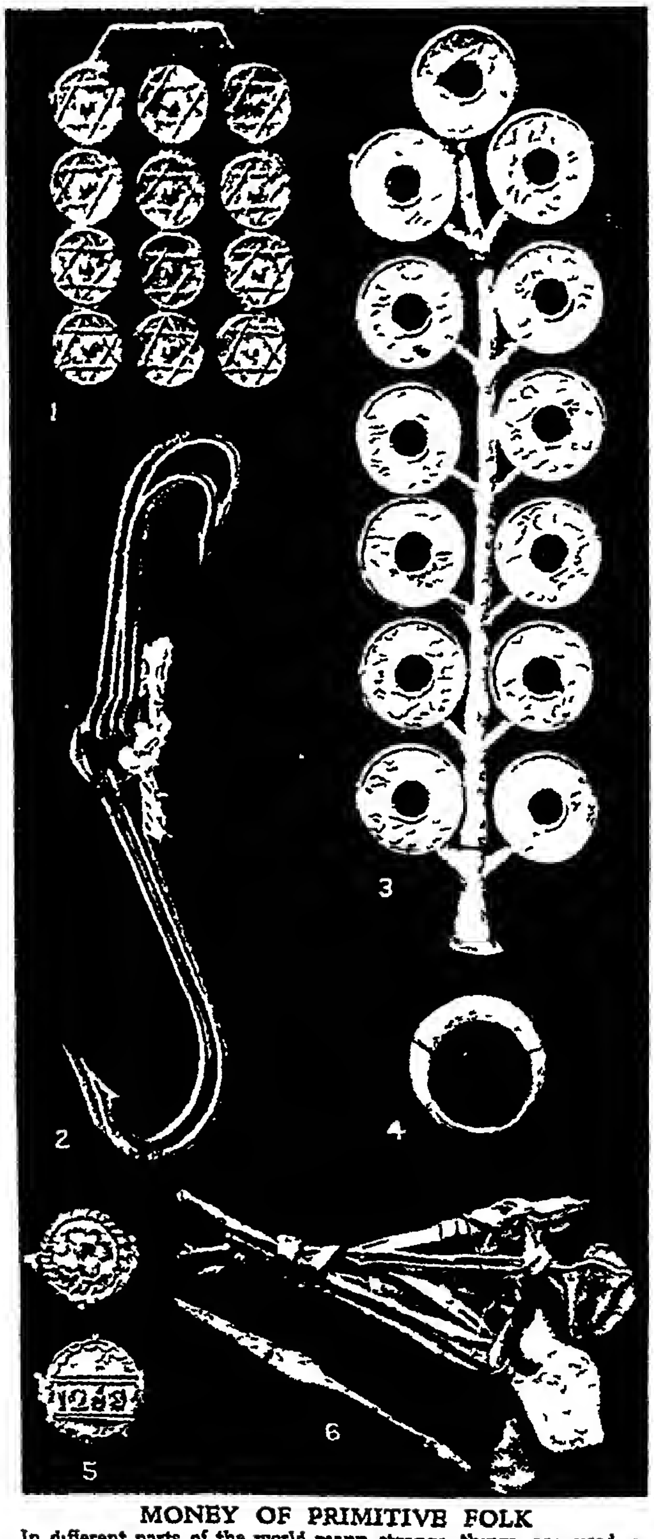
Barter, which is direct trading without money, is supposed to have existed in many parts of the world before money was thought of Even now barter has not completely disappeared, and the price of many new motor-cars is paid in part with old cars in "part exchange" Such barter is usually preceded by an agreement as to the money value of the things to be traded

To appreciate the importance of money as a medium of exchange, we must recall the extent to which we today carry on production by division of labour—*specialization* Only a few people produce completed articles Most of us contribute only some part of a specialized article or service We have to exchange our specialized contributions, which often have no tangible form, for the many things we use The values of these goods and services are measured in money units Without money, we could hardly have so high a degree of specialization, which is an extremely efficient way to produce goods

There are several ways in which one can "store up" savings One way is to buy goods which last, such as buildings or land A second is to accumulate claims against the future income of others This may be done by lending money to individuals, or by buying shares or

stocks of companies (*see* Stocks and Shares), or by buying life assurance, or by putting money into a savings bank A third way is merely to keep the savings in the form of money Money thus used is said to be serving as a "store of value' The difference between this last way of saving—"hoarding," it is sometimes called—and other methods of storing up values, is that the money can be spent at any time It is a claim, so to speak, against the products of the community in general whereas purchases of securities, deposits in banks, and loans to individuals are claims against companies or persons

Primitive races have tried all sorts of commodities as money Some of these things have had no intrinsic value except from their use as money Shells, beads, tobacco, furs, skins, hatchets, salt, rice, tea, dates, and ivory are among the types of money used by primitive peoples Sparta used iron, many nations have used copper or brass The early Romans, as have many other peoples, measured their wealth in cattle, and their word for "money" was *pecunia*, from *pecus* (meaning "cattle") White and purple "wampum" beads, made of sea shells, were the money of the North American Indians, as cowrie shells were of the natives of Africa and Hindustan The value of this shell money was due at first to its attractiveness as ornaments, but it was greatly increased by its usefulness as money



MONEY OF PRIMITIVE FOLK

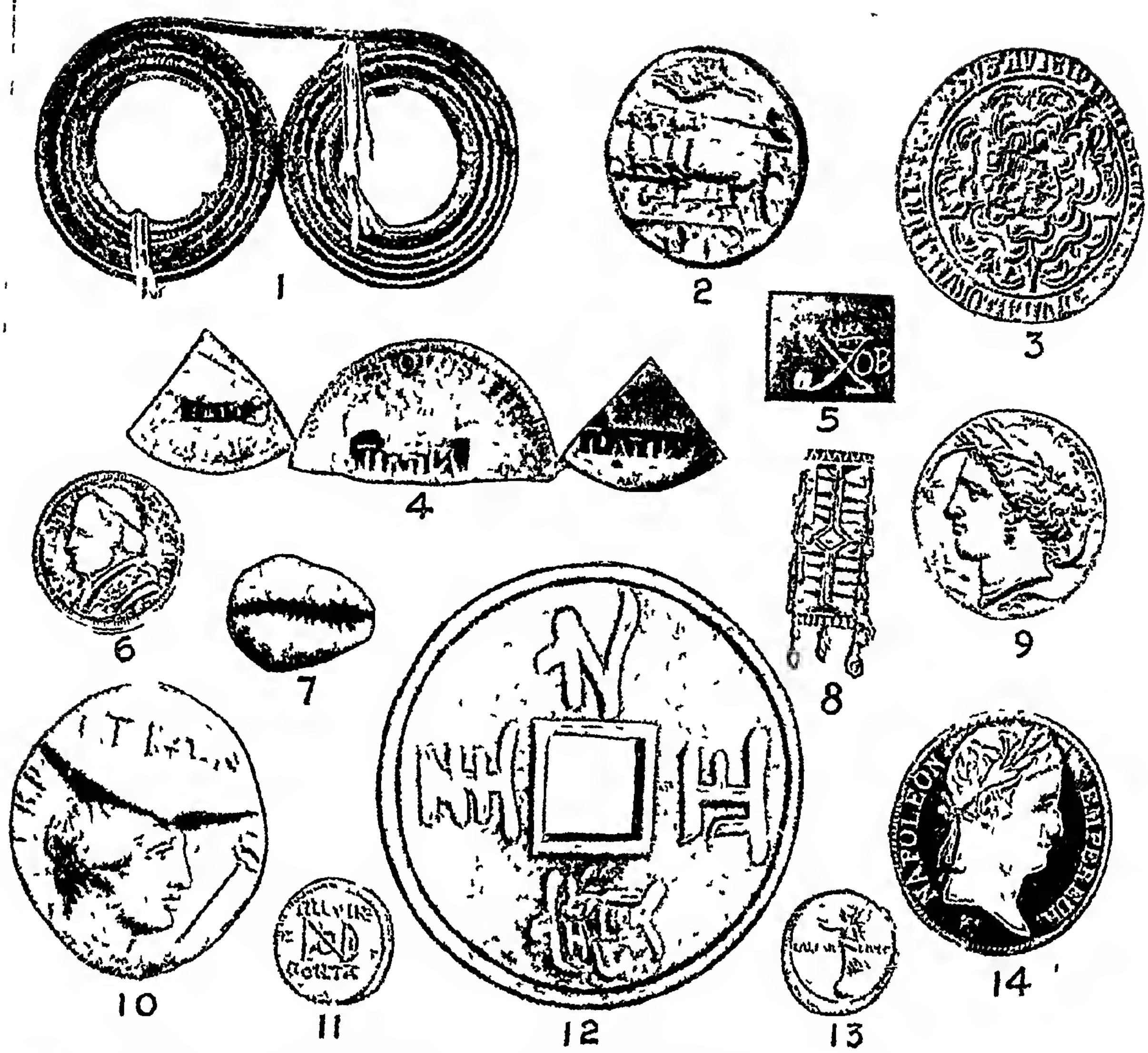
In different parts of the world many strange things are used as money Above, for instance, are 1, Moroccan coins cast in a mould and divisible as (5) for small change, 2, fish-hook money from islands off Alaska, 3 tin "tree" money from Malacca with detachable coin branches, 4 Zulu ring money, 6, primitive African money in the shape of miniature weapons

From the Zerbe Collection

Metals, it was found, make the most satisfactory money Silver or gold, or both, came to be used for large payments, and copper for smaller payments In modern times, except in China and a few other places copper has ceased to serve as 'standard money,' though it is widely used for "token" coins These are coins which may be used only for small payments

Gold and silver have many advantages over most commodities which have been used for money They are easily recognizable, and can be cut or moulded or hammered into ingots of convenient size They do not deteriorate with age, and are not easily damaged or worn Their value is sufficiently high for amounts suitable for ordinary transactions to be handled easily And, finally, they are more stable in value than are most commodities, because the demand for non-monetary uses is steady and the supply in existence is so large that it is not affected by sudden changes in production.

At first gold and silver passed by weight, as gold dust often does still in mining communities Several of the common units of money were originally names of weights—as the Hebrew "shekel" and the Anglo Saxon "mark," the later English "pound,



MANY MONEYS OF MANY DIFFERENT PEOPLES

Here is a further selection of kinds of money used amongst peoples widely-separated in geography, time, and degree of civilization 1, feather money of Melanesia, 2, ancient Greek coin, city of Syracuse, 3, gold sovereign of Henry VII of England, 4, Spanish coin, cut into halves and quarters for use as currency by Peru, 5, Swedish oblong money, 17th century, 6, lira issued by Pope Pius IX, Pope 1846-1878, 7, cowrie shell used in the South Sea Islands, 8, wampum, used for ornamental purposes by Red Indians, 9, coin of the city of Amphipolis (ancient Greek), 10, head of Hermes, god of commerce, on a coin of Sybrita, a Cretan city, 11, coin of Alfred the Great, 12, Chinese cash, 13, Roman republican coin, Octavian (afterwards Augustus), 14, twenty-franc "Napoleon," 1812

the older French "livre," and so on Indeed, coinage was originally merely a way of certifying to the weight and fineness of an ingot of precious metal, so that payments could be made by count The earliest known coins were those of the Lydians in Asia Minor, dating from the 7th century B C China and India may have had coins even earlier Even after coining began, the coins were often weighed, because dishonest people clipped or filed the coins to obtain the particles of gold or silver It is to prevent such "theft" that modern gold and silver coins are made with raised and "milled" edges

In the ancient world, and also throughout the Middle Ages, money circulated on the basis of its metallic content, real or supposed True, kings sometimes took advantage of their power and "debased" the currency by putting out new coins smaller than those issued in the past or by putting in more alloy, thereby they cheated their creditors when government debts were paid, and incidentally gave all other debtors something at the expense of their creditors But in the early modern period it was discovered that a *promise* to pay money, if there was general confidence in the maker of the promise, would serve most of the purposes of real money Goldsmiths, merchants, and money-lenders began to issue notes—written promises to pay cash on demand This *credit currency*, being in the form of paper, was more convenient and safer to handle than the gold for which it could be redeemed It was also less expensive to transport and to store The issuing of such bank-notes became one of the important activities of the banking business

Another form of credit money is the *bank deposit* The banker merely gives a receipt for

money deposited, and allows his customers to transfer these deposits among themselves by instructing him to transfer amounts from one account to another (*See* Banks and Banking)

Governments, as well as bankers, issue paper promises to pay gold or silver on demand Sometimes they have observed their obligations scrupulously, keeping large reserves of coin on hand for redeeming their notes, and never making the issue of new paper a method of paying current expenses without taxation Such governments are said to have " sound " money Other governments have made a practice of issuing notes without having the gold or silver to back them, and without providing for the redemption of the notes Such currencies fluctuate greatly in value and cause great risks to business men and losses to everyone

Temporary issues of paper money which will soon be redeemed out of taxes have been used successfully by many countries But frequently governments which use this method of financing find that their revenues never catch up with their expenses The paper begins to go down in value as increasing amounts of it are offered in the market for goods, in other words, prices of most commodities rise The rise in prices increases the expenses of the government and an increased issue of paper is required Presently people get alarmed and try to spend their money more quickly than usual for fear it will lose more of its value This puts prices still higher So the situation grows worse

Such an over-issue of paper money is called *inflation* Sometimes in the past the inflation has proceeded to great lengths For example, after the World War a number of countries passed through most amazing inflations, Austrian currency went to 1/70,000 of its pre-War gold value, while Germany's was worth practically nothing Such practices result in the financial ruin of thousands of people who have wealth in the form of money or claims to money

The value of any article expressed in terms of money is known as its *price* The value of money is not stated as a price, since that would only be stating the value in terms of itself The price of standard money, if we used the term, would never vary, but when its *value* goes up, the prices of other things fall, and when it loses value other prices rise As prices of different commodities do not move exactly alike, it is customary to measure the changes in the value of money by taking an average of the prices of a large number of commodities Such an average is called an *index number* A succession of such averages for different dates is

NEW DESIGNS ON BRITAIN'S COINS *Fox Photos*

As soon as a new Sovereign comes to the throne the Royal Mint gets busy with preparing coins stamped with His Majesty's effigy The lower photograph shows a heap of the new, twelve-sided threepenny pieces first issued in 1937 and top we see in reverse the range of the British coinage of King George VI, from half-crown to farthing The shilling and sixpence shown are of the special Coronation issue

called a series of index numbers By looking at such a series one can see the changes in the value of money for that period

There has been much dissatisfaction with the pre-War gold standard and still more with the post-War standard because of the instability of the value of money, as shown by index numbers

Attempts have been made to work out a system of money which would be more stable than any of the standards used in the past Among them is the suggestion of Prof Irving Fisher, the American economist, that the weight of the gold dollar should be increased when prices as shown by an index number are rising, and lowered when they are falling Thus the value of the dollar (at least as shown by the index number), instead of its weight, might be kept steady Others have urged that the same end should be achieved by changing the amount of bank credit which will be permitted to rest on a given amount of gold or other reserve money, or that interest rates should be controlled so as to control the amount of bank credit indirectly A system under which the value of the currency is controlled by these indirect methods, without any direct redemption in precious metal, is called a *managed currency* A leading exponent in Britain of this system is Mr J M Keynes

Probably most of the world's financiers believe that it would be best to go back to a gold basis for currency at the earliest opportunity, although the more advanced (e g, Mr Keynes) talk of gold in this connexion as a mere fetish

The paper money in universal use is a piece of suitably engraved paper that merely *represents* a certain amount of gold or silver coin A gold coin loses some of its precious metal by rubbing or abrasion if it passes continually from hand to hand Also, in large amounts it is very heavy to handle The Bank of England issues bank-notes (of from 10s upwards) that serve the same purpose, and are covered in a certain proportion by gold These notes and gold are legal tender to any amount, though sovereigns and half-sovereigns are not often met with by the man-in-the-street

British "Standard Gold" is of 22 carats—*i e* 2-24ths of its composition is alloy Silver coinage now consists of half pure silver and half alloy Bronze coins are made of an alloy of 95 parts copper and tiny quantities of tin and zinc (*See* Coins in the Fact-Index, Gold Standard, Foreign Exchange, Mint, Royal)

CARAVAN ON THE MONGOLIAN STEPPES

Mongolia, one of the least-known and yet one of the largest countries of the world, has been throughout historic times the home of tribes of nomad hunters Horses and camels are their beasts of burden, and here is one of the latter being loaded up with furs recently secured by its master

Mongolia. Between Siberia and China, with Manchukuo to the east, lie the vast Asiatic plains and mountains of the indefinite tract of land called Mongolia, about 1,500,000 square miles in extent It forms a gigantic basin-like plateau, of 3,000 to 4,000 feet elevation, surrounded by mountain ranges and steppes The whole region falls into three terraces, of which the highest is the mountainous plateau of north-western or Outer Mongolia, the second is the great Desert of Gobi (260,000 square miles), the third is the plain of eastern or Inner Mongolia, intersected by the Khingan Mountains Its chief rivers are the Hwang-ho, a great bend of which flows through the south, and tributaries of the Amur and Yenisei in the north The chief city is Ulan Bator Khoto (formerly Urga) (40,000 population), the capital of the Mongolian People's Republic (Outer Mongolia) This lies towards the northern border, and is an emporium for the caravan trade between Siberia and China

Fierce winds seem to blow for ever over the Gobi desert The heat of the summer sun smiting through the dry air makes the bare rock almost blistering hot Through the same dry air in winter the heat of the land radiates and is lost, and temperatures may fall to $-40°$ F

In the Gobi and in the less fertile parts of Inner Mongolia the Mongols live a nomadic life

MONGOLIA'S SITUATION IN THE DESERT AREA OF ASIA

This map shows the nature of the Mongolian country—a great plateau lying about 4 000 feet above sea-level and bordered on three sides by mountain ranges, with the Gobi desert towards the centre. The political boundaries are also marked so far as they may be determined. This remote Asiatic country has of late assumed a fresh importance in view of the fact that it is now a buffer state between Soviet Russia and the Japanese-controlled Manchukuo.

Finding water is the Mongol's greatest problem. He seldom uses precious water to wash his body or his clothes; he licks his dishes clean with his tongue. As water and pasture fail in one locality, he must move his herds elsewhere; so he uses a movable dwelling, and makes his utensils of wood instead of breakable earthenware. The rainfall of between 8 and 12 inches a year supports steppe grass, but agriculture is impossible over most of the country. This suits the Mongol perfectly, for he despises a farmer's life and likes to wander with his herds. From their herds the Mongols get almost everything they need. The sheep furnish mutton, cheese, butter, sheepskin clothing, and wool for making the felt used to cover their movable homes, or *yurts*, and for bedding. Goats are kept, and in a few localities outside the Gobi the Mongols raise cattle. Most of the cattle are traded or sold, for the Mongol prefers mutton. Milk from mares and cows makes a fermented drink, *koumiss*.

Sheepskin is the regular garb in winter, cotton cloth in summer. Both men and women like to dress in gay colours. On festal occasions the women wear a gorgeously ornamented head-dress. It is said that a Mongol's wealth may be judged by the jewels in his wife's head-dress.

HOW MONGOLIAN WOMEN DO THEIR HAIR

The ladies of Outer Mongolia dress their hair in huge grotesque bows shaped like the horns of a mountain sheep and ornamented with jewelled metal work. Once the coiffure is "set" it remains in place for weeks. The red spots on the woman's cheeks indicate high rank.

Furs, hides, wool, camel's hair, and animals are bartered for foreign luxuries like tea, flour, sugar, tobacco, the cotton cloth used for tents and summer clothing, saddles, boots, and jewelry for the women. Camels are used to carry loads and draw the high-wheeled carts, but Mongols rely mostly upon horses for transportation. Boys learn to ride at four

Next after horses to ride, the Mongol needs dogs, the more savage the better, to guard his yurt or caravan These dogs are very ferocious, and will attack a stranger at sight

The population, uncertainly estimated at about 1,800,000, consists of Mongols, Chinese, and Tunguses The industries are almost undeveloped, cattle raising and transportation being the chief occupations Inner Mongolia until 1935 acknowledged Chinese suzerainty The Mongolian People's Republic is nominally independent, under a government run on Soviet lines The same applies to Tannu-Tuva, a republic in the north-west corner of Outer Mongolia

Mongols. The story of these slant eyed nomads, with their flat, yellow faces, is one of the strangest in history A rude, almost unknown tribe or group of tribes, learning the art of war in obscure struggles with each other and with their Chinese overlords, they suddenly blazed forth in the 13th century under brilliant military leaders as conquerors of the best parts of Asia and eastern Europe, supplanting native dynasties in one great kingdom after another Again and again, when the force and ability of the original stock seemed to be exhausted, fresh and vigorous offshoots renewed the career of conquest Finally, after making the Mongol name a world terror for several centuries, they have sunk back again into grey obscurity as docile subjects of realms in which they once ruled

KUBLAI KHAN, A MONGOL EMPEROR

From the Black Sea to the coast of China spread the domains of Kublai Khan, one of the greatest rulers of the Middle Ages His court, as Marco Polo witnessed, was highly civilized

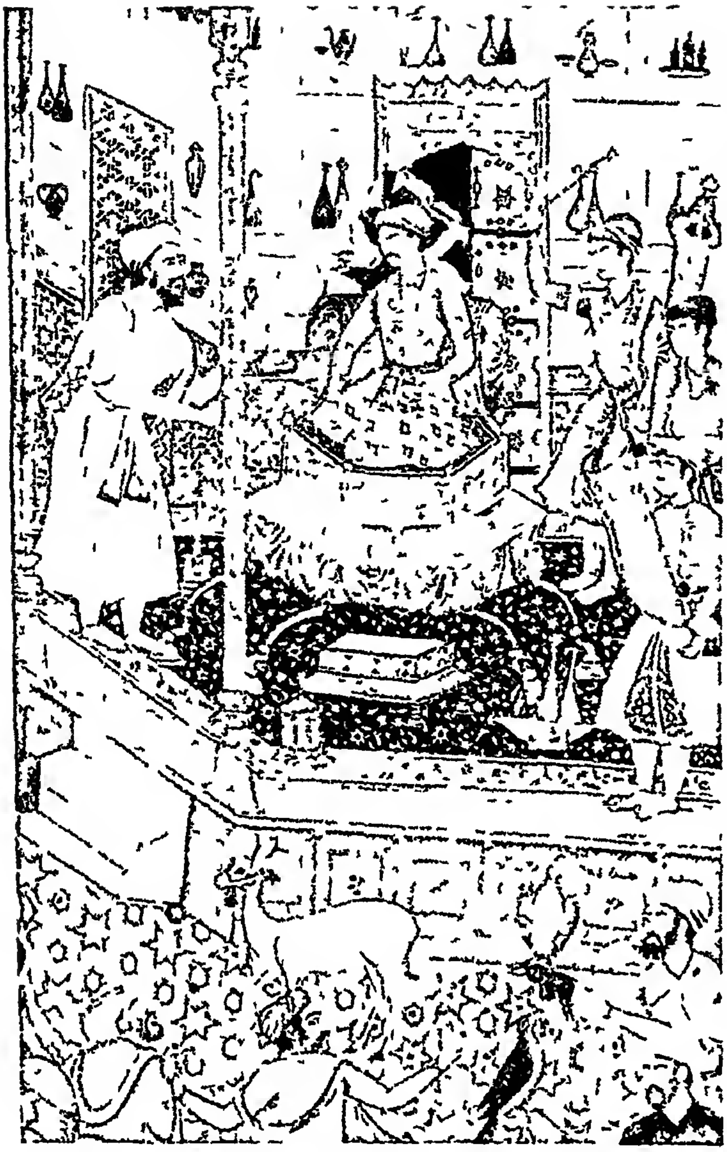
From A Binyon 'Introduction to Chinese Painting'

Squat wiry horsemen, hunters, and herdsmen, the tent-dwelling Mongols roved over the cold mountain region south of Lake Baikal and the open steppes In the early 13th century Jenghiz (Genghis) Khan (1162–1227), having welded his wild tribes into a strong and efficient fighting machine, turned it first against the neighbouring Tartar tribes, which he amalgamated with his own, and then against the already collapsing Kin dynasty of China He took Peking in 1214, and subdued all China except a small portion in the south Then, turning his armies westward, like nightmare apparitions out of a dim land of fable, against peoples who had never heard of Mongols, he swept over Turkistan, Persia, and the southern part of the Grand Duchy of Kief in Russia

A grandson of Jenghiz, Kublai, who became Great Khan in 1260, completed the conquest of China and founded the Yuen dynasty, which ruled there until 1368 Sovereign or overlord from the Black to the Yellow Sea, Kublai Khan was ruler over more human beings than had ever before owed allegiance to one man The first of his race to evince traits of benevolence or magnanimity, or any interest in arts or culture, he had adventurers from as far west as Constantinople and even Venice among his ministers, generals, governors, envoys, physicians, and astronomers It was during the reign of Kublai Khan that the first reports of the wonders of "far Cathay" came to the ears of an astonished and incredulous Europe through the tales of the returned Venetian traveller, Marco Polo

In the 14th century a Mongol chieftain of Turkistan, said to be of Jenghiz Khan's blood, though not a direct descendant, once more erected a huge "empire of desolation" covering Persia, Afghanistan, northern India, Mesopotamia, and the greater part of Asia Minor This was Timur i Leng or Tamerlane (Timur the Lame), whose career was used by the great Elizabethan dramatist Marlowe as the basis for his tragedy "Tamburlaine the Great" His crowning achievement was his conquest of Asia Minor from the Turkish Empire through the defeat and capture of Sultan Bajazet I in 1402, but, like their opponents, these Mongols were of Mahomedan faith His power died with him in 1405, though his descendants for a time retained a shadowy authority in Persia

About a hundred years later one of Timur's descendants, Babar (1483–1530), the exiled and outlawed ruler of a petty kingdom in what is now Russian Turkistan, became the Mahomedan conqueror of northern India and the founder of the Mogul (Mongol) empire of India



MONGOL RULER OF INDIA

Greatest of all the "great Moguls," Akbar was the first Indian ruler with whom the English had dealings. He ruled from 1556 to 1605, doing much to unite India into one great empire. He is here seen seated in state on his imperial throne, giving audience to a traveller

Crown copyright Victoria & Albert Museum

Akbar, Babar's grandson, who ruled India from 1556 to 1605, showed a genius for rule as well as conquest; more, he was a robust and broad-minded statesman who attempted to create a united India out of its unhappy jumble of warring races and religions. He was not merely one of the greatest of Indian rulers, but "one of the hinges of history." In his reign England first entered into relations with India, and he was "the Great Mogul" to whom Queen Elizabeth sent a letter. None of Akbar's descendants came up to his stature or had his vision, though his grandson Aurungzebe extended the limits of the Mogul Empire. But that power was internally decaying at Aurungzebe's death, in 1707, and under his feeble descendants in the 18th century it fell into the hands of English rulers. (See India)

The Mongols of the present day are one of the chief branches of Asiatic peoples. They are divided into the East Mongols, living in Mongolia and Tibet; West Mongols or Kalmucks living in Mongolia and Siberia; and Buriats, living around Lake Baikal, Siberia. They are still tent dwellers and nomadic herdsmen. Most of them are Lamaistic Buddhists; a few are Mahomedans; and the Buriats still hold to their ancient form of spirit worship, Shamanism.

Mongoose. Though you may never see a live mongoose, you will know all about this animal from the account of Rikki-tikki-tavi in Rudyard Kipling's "Jungle Book." 'Rikki-tikki,' you will remember, spent his time in killing snakes; and this, indeed, is the chief business of the mongoose in all parts of the world. These small animals belong to a family which is akin to the weasels, and there are a number of genera and many species, mostly in Africa and Asia. In Egypt, where it is called ichneumon, it was held sacred by the ancient inhabitants, probably because of its usefulness in killing poisonous serpents.

The Indian mongoose (*Herpestes mungo*) is a quick slender animal, about 16 inches long. In spite of its fierce disposition it is easily tamed, and it is of real value as a killer of snakes. When introduced into the British island of Jamaica in the West Indies, the mongoose multiplied so rapidly as to become a serious pest, killing game, poultry, and other birds, as well as snakes and rats.

MONGOOSE LIKES HIS DAILY EGG

Although it is chiefly as the enemy of snakes that the mongoose is famous, he is really happier when he has an egg to eat, this being his normal food. The plural of mongoose is 'mongooses,' the Tamil name being [illegible]

WHO'S WHO *in* MONKEY-LAND

So funny are the monkeys in their looks and ways that there is always a big crowd around the monkey-house in the Zoo. In this chapter we make the acquaintance of many members of the playful tribe

Monkey: Can you think of anything that will collect a crowd of children so quickly, or keep them happy so long, as a street musician with a monkey? The music may be dreadful, but the monkey is very funny. His tiny wrinkled face is so comical. It looks like that of a wise little old man who has seen a great deal of trouble. Like a good clown in a circus, a monkey doesn't have to do anything to make people laugh—except just *be* a monkey. He is so wonderfully agile, quick, and clever. He mimics everything people do. He "makes faces," and he dances to music; he runs up a telegraph pole, a tree, or a porch pillar, and he swings from bars like a trapeze performer. He picks up pennies, stuffs them into the pocket of his absurd red jacket, and pulls off his cap for thanks.

The proboscis monkey
Photo Gambier Bolton

It seems a pity that a monkey can only chatter or scream or scold, for he tries ever so hard to talk. So mischievous he is, too! If he sees a chance he will snatch a little girl's doll or a woman's hat and tear it to pieces. He knows very well that such behaviour is naughty, for he scrambles out of reach of punishment, and chuckles with glee over the trick. It's easy to forgive the little rascal, for the next instant he does something engaging. He cuddles his baby, or cracks a peanut like a squirrel, turns a hand-spring for you, or slyly pulls another monkey's tail. But just what *is* a monkey?

Although the word "monkey" probably conjures up for you a picture of a small, hairy, agile individual with a long tail, these animals are actually among the most various of all creatures. Some monkeys are as small as squirrels and others are as large as cocker spaniels. There are monkeys with long curly tails, with straight tails, bushy tails, stubby tails, or no tails at all. Some have very hairy, and others nearly naked, faces. There are dog-faced and purple-faced monkeys; monkeys with white cheeks, with turned-up noses, with tufted ears, with whiskers, mufflers, and bonnets. Most of them are black, grey, or some shade of brown, from silver-fawn to seal. But there are dandies with green coats and orange vests.

Many people include the big apes—the gorillas, chimpanzees, orang-utans—under the name "monkey." But this is incorrect. These higher forms are *apes*, and there is a greater difference between the lowest apes and the monkeys than between the apes and Man. (*See* Ape.)

You would not suspect that the word "monkey" comes from *monna*, a contraction of "Madonna," which is Italian for "my lady," though this is one of various suggested derivations. The name was given to lower forms of the order Primates (Man-like animals) perhaps because of their fancied resemblance to old women.

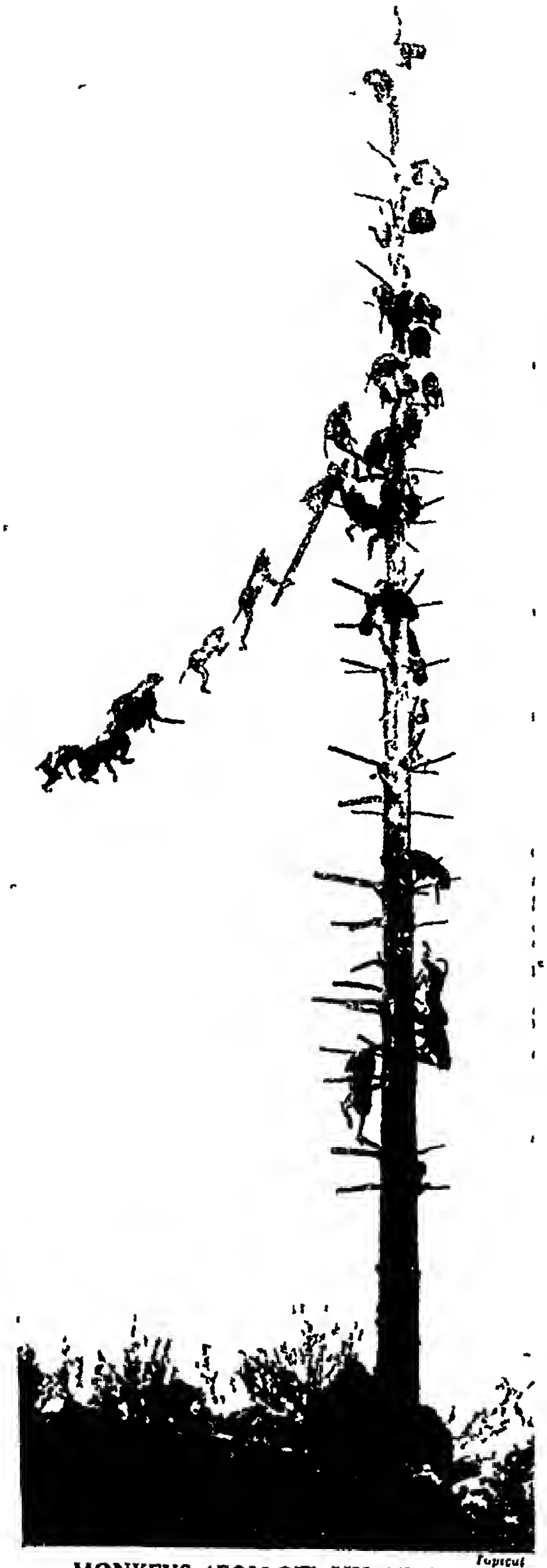
Monkeys inhabit the warm regions of both hemispheres. They are found in China, Japan, India, and southern Asia, including also the Malay islands, and in all parts of Africa except the deserts. In Europe they are found only at Gibraltar. The New World monkeys are found in the tropical regions of Central and South America, east of the Andes Mountains.

A monkey in captivity is happier in a cage with a number of other monkeys. "The more the merrier" is the rule in monkey-land and nearly every kind of monkey lives in a village in the trees, when he is at home. There is a wise old male for a chief. He and the older males keep trespassers away from a chosen feeding-place, and he leads his followers to a new home when they move. Early in the morning and late in the evening seem to be play time in monkey town. All the monkeys leap and swing and chase one another through the trees, and chatter like boys playing in a wood.

Monkeys love the dense forests of very hot countries. In the beautiful tropical forests along the river Amazon in South America, they make their homes in boughs in the trees. They live in thousands on the tropical islands, among palms and fruit trees, and only a few are found in colder countries.

Monkeys Have Four Hands

No matter how much monkeys may differ in other things, they are all alike in having four *hands*. The bear, the lion, the elephant, the dog—nearly all the animals you can think of—have four *feet*. Girls and boys have two hands and two feet. A foot has a long sole and short toes, usually, and the toes cannot grasp and hold things. A hand has a nearly square palm, fingers much longer than toes, and a thumb. In the best kind of hand the fingers have three joints each, and can all be brought together, and even closed into a fist.



Topical

MONKEYS 'FOLLOW MY LEADER'

These monkeys in an American Zoo found a cable stretched between two trees and one bold adventurer having shown the way they all followed him along it. Up to the top he went, turned, came down again—and they all came tumbling after.

All four of a monkey's feet are really hands, with grasping fingers and more or less perfect thumbs. That is why a monkey is so clumsy on the ground. Usually he walks on the outside edges of the palms of his hands, with fingers and thumbs curled in. This gives him a funny bow-legged look. But just watch him on a tree or a perch, or clinging to the wires of his cage. He is as much at home in a tree as a bird or a squirrel.

The monkeys of the Old and New World have been separated for so long that they now have several very distinct features. Thus, if you give an Old World monkey nuts, he will stow them away in cheek pouches like a squirrel. He can put a surprising number away, for those pouches stretch and stretch like little rubber balloons. He has a flat nose with the nostrils close together. And when he goes up to a perch to eat his nuts he does not use his tail in climbing or for holding on.

Monkeys of South America

A South American monkey's nostrils are far apart. He has no cheek pouches, but heaps as many nuts as he can carry in his two front arms, as you carry oranges. But he can keep other monkeys from taking his nuts when he climbs, for he uses his long curly-tipped tail as a fifth hand.

With *five* hands for grasping, the South American monkey is a wonderful trapeze performer. The tree squirrel climbs faster, the flying-squirrel leaps farther, the bat clings better with his wing-hooks, but no other animal can climb, leap, and swing across a wide forest, 40 feet from the ground, as the South American monkeys can. They do not leave the trees except in case of necessity, and they drink while clinging to a bough which overhangs the water. They feed on leaves, fruits, insects, eggs, young birds, and honey. The American monkeys seldom damage Man's property, but they are hunted for their flesh and fur.

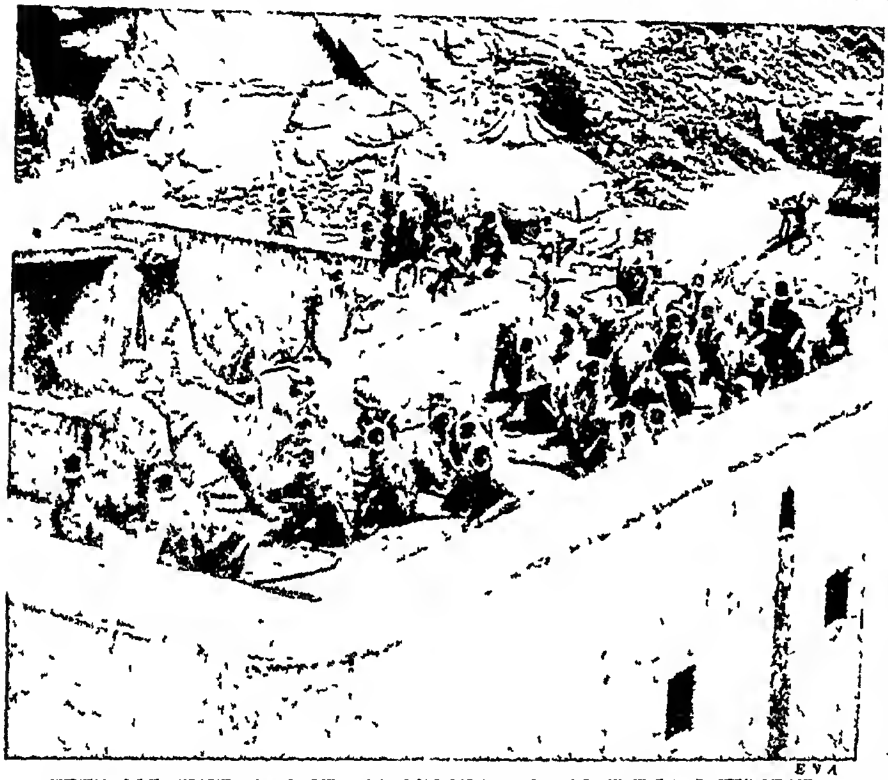
The South American monkey that you may see with the organ-grinder is a small rusty-brown animal, about as big as a toy terrier. He has a curved hair-covered tail, good thumbs, a rather pleasant whistling chatter, and a care-worn, anxious face, as if he expected nothing in life but bad news. He is bright and obedient, so he soon learns his tricks and performs them willingly. He likes to ride on a dog's back, on his master's shoulder, or on the organ. Another favourite of the organ grinder's is the Capuchin monkey. You may know him by the way the hair grows round his face, like a hood or cowl.

Unlike the other South American monkeys, the marmoset, the smallest and prettiest of them all, cannot use his tail in climbing. He is only 8 inches long, with a furry body and a foot-long bushy tail that he carries like a plume.

If it wasn't for his almost human little face and hands, and his wing-like tufted ears you might think him a squirrel

There is a squirrel monkey from South America only a little larger than his nut-cracking namesake He has a grey face and a black nose, but has long hind legs, so that he leaps somewhat like a kangaroo In his home in the Amazon forests it rains torrents sometimes, as if the bottom had fallen out of the clouds When caught in such a storm a troop of these squirrel monkeys huddle together in the thickest tree they can find, and put their tails around one another's necks for company and comfort

These marmosets and squirrel monkeys have some of the noisiest neighbours—the "howling" monkeys They have a larynx or voice box with six pockets, which reflect the voice and give it unusual strength They begin howling at sunrise, keep it up until the next sunrise, and then make a fresh start The woods ring and echo with their howls They travel all the time through the high branches of the trees, the males leading and the mother monkeys following, each with one or two babies clinging to her neck with fingers and tails They swing by their tails and catch the next limb with a hand The brown howler is bad enough, but the red howler makes even more hideous cries



FEEDING THE SACRED MONKEYS OF AN INDIAN TEMPLE

One of the attendants of this hill temple in Jaipur, India, is feeding the sacred monkeys, which come down for their daily ration from the hillside above No one would dare to harm these little creatures, for they are under the protection of the god who is worshipped at the shrine In the dim past, monkeys were regarded as objects of worship themselves

Another South American monkey is the saki He has a ruddy back, and an almost human habit of cupping a hand and scooping up water when he wants to drink He is so delicate that he seldom lives long in captivity, so you may never see him

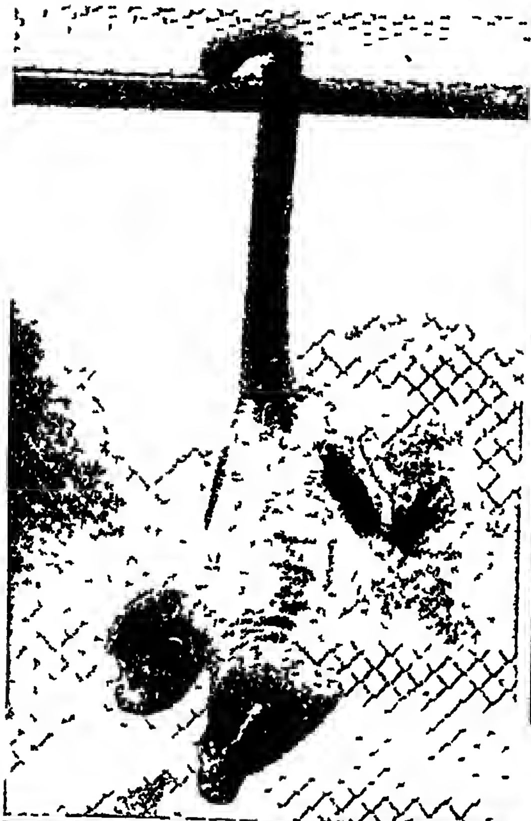
But you are sure to see the spider monkey He has such long, slim arms and tail and such a small body that he looks like a big, hairy spider But really he is very gentle and even affectionate He has tiny stumps of thumbs that are of little use to him, and he is not as agile as many other monkeys A mother spider monkey likes to sit down and cuddle her baby

So many of the Old World monkeys have only little stubs and lumps of thumbs that scientists class them in one family of "cut-off-thumb" monkeys If you see a monkey with a very fine, long-haired silky coat, particularly if he has cheek pouches and makes no use of his tail, look for shrunken little thumbs His coat makes pretty monkey-skin collars and muffs One monkey of the mountains of Abyssinia where it is cold, looks as if he were wearing furs himself He has a fringe of white down on either side of his jet-black velvet body, a white tippet under his chin, a white edge to his cap, and a white tip to his tail Another monkey of the hot west coast of Africa wears the hair on top of his head in a crest, with a parting on each side, he also has whiskers under his chin

The African guenon is a small graceful creature with fine hands, long thumbs and tail, big cheek pouches, and large hairless "callosities" on his "seat" He is a lively, merry monkey, doing much damage by raiding cornfields, most of the crop being spoiled by his attempts to select the choicest ears

Among the brightly-coloured monkeys there are a red- and a purple-faced monkey, a Diana monkey, with a pretty white crescent like a new moon on the forehead, a white beard and neck scarf and a monkey with a blue

STRANGE MEMBERS OF THE MONKEY TRIBE



These four pictures give you some idea of the great variety of form and appearance which is shown by the monkeys. Top left is Humboldt's woolly monkey, whose tail is evidently very useful. Next to it is a pig-tailed macaque with its baby, a most unprepossessing little creature. On the left below, is a white-tailed colobus monkey, a pleasant-looking individual which also has white whiskers, and, finally, bottom right, we have the extraordinary white-headed saki.

Photos F W Bond; W S Berridge

IS HE THE MOST HIDEOUS OF ANIMALS?

Few creatures in the whole world of mammals are so ugly as the mandrill, which is the largest and most powerful of all the baboons. The colour of its nose and eyebrows is brilliant red, while the curious cheeks are bright blue

Photo H S Berridge

Another mischievous monkey is the Barbary ape or magot, who lives in north-western Africa and Gibraltar. He is about as big as a terrier. He and all his relations will go to a fine garden and set sentinels in trees and on rocks to watch, while the others eat and destroy the melons, figs, grapes, oranges, and almonds. An alarm sends them flying.

The street strollers of India, Japan, and northern Africa lead about the macaque (*ma*-kahk) or "bonnet" monkeys. They are sturdily built, with short tails, and their hair grows in a frill round the face. Some of these monkeys love crabs so much that they have learned to swim and dive for this favourite food. The pigtailed bonnet monkey of the East India islands is used on plantations to climb up the tall palms and pick coconuts.

In the East Indian island of Borneo is found the long-nosed or proboscis monkey, a slender species with the nose of the adult male long and beak like. His nose is not only movable in all directions, but it can be retracted or protruded at will. The fur is red, thick, and soft, and about the neck it is nearly a foot long, forming a heavy collar.

The baboons or dog-headed monkeys are among the ugliest and most repulsive members of the monkey tribe. In size and habits they come

moustache above yellow whiskers—he is called the "moustache" monkey. The green monkey, whose home is in the region of the Nile, is quite a dandy. He is dressed in dark green and black, set off with dull orange whiskers, throat band, breast-plate and tail tip.

The Hanuman monkey of the East Indies is a little spider-legged animal 3 or 4 feet long, with cream-coloured fur and black hands and face. In his native land he is sacred to Hanuman, the monkey god, and so he is never interfered with. He goes in troops into the villages, helping himself to grain, fruits, and nuts in shops and houses. Stories are told of whole tribes of the Hanuman monkeys swarming into dining-rooms and eating wedding feasts. In some Hindu communities these monkeys live in the top storeys of the homes of the natives. If one native bears another a grudge, he places rice or corn on the enemy's roof during the rainy season. When the monkeys see this they eat the grain that is within reach, then tear up the tiles of the roof to secure particles which have fallen into the crevices, so that the house is opened to the rain.

between the true apes and the tree-dwelling monkeys. They are made especially hideous by large bare spots, often brilliantly coloured, on their hind quarters. Their long blunt muzzles, with nostrils at the extreme end, and the great canine teeth give their faces a dog-like appearance. They run swiftly on all fours and climb trees with difficulty. They hunt in great droves, and, led by their old males and guarded by sentinels often defend themselves against other wild beasts. Their food is chiefly insects, small animals, vegetables, and fruits. In their raids on plantations they often work great havoc.

The Repulsive Mandrill

About a dozen different kinds of baboons are known, of which the mandrill is the largest and fiercest. This brute, said to be the most hideous of all animals, is larger than a mastiff, it has short legs, a heavy body, immense canine teeth, and a stump of a tail less than 2 inches long. It is especially remarkable for the brilliant flower-like hues of the hairless portions of its face and body. Its cheeks are an intense blue, while the central line of the nose is a brilliant scarlet and it is immensely strong.

The powerful hamadryad (ham *a*-drī'-*a*d) baboon of Arabia and north-eastern Africa was worshipped by the ancient Egyptians, and its solemn appearance gained it credit for great wisdom. It is remarkable for the shaggy coat of greyish-green hair that covers its head and shoulders, and the flaming red of its callous spots.

Amazing stories are told of the intelligence of the chacma baboon of South Africa, which is nearly as large as the mandrill, but is much more gentle in early life. In several instances chacma baboons are said to have been trained to act as shepherds, driving their woolly charges to and from pasture and protecting them with passionate devotion; in defence of their young or their females they do not hesitate to attack leopards, pythons, and even men. Their span of life is thought to be nearly equal to that of human beings. Finally, there are the European baboons, of which a few remain at Gibraltar.

The Three Wise Monkeys of Japan

THESE are the three wise little Japanese monkeys, who "see no evil, hear no evil, speak no evil." They are carved in an open grille panel above the door of the royal stable in the group of temples at Nikko, Japan. Their names are Mizaru, "see no evil" (at the right of the panel), Kikazaru, "hear no evil," and Iwazaru, "speak no evil." The intricate wood carving, delicately coloured in shades of green, pink, peach, and brown, is the work of Hidari Jingoro (1594–1652), the great left-handed ("hidari" in Japanese) artist who did many of the finest carvings at Nikko.

The Three Mystic Monkeys, known in Japan as the Sambiki saru, represent Buddhist teachings on the three principal temptations. The idea is very old, for the three monkeys are represented in ancient Japanese statues showing Hindu influence; *they appear on the head-dress* of one of the ancient deities. The Sambiki-saru are associated with the long-nosed Shinto god, Saruta Hiko, and they are the attendants of the Buddhist Koshin, god of the roads, who is generally depicted in Japanese art as a monkey-headed man.

The stable at Nikko houses the sacred white horse, kept for the use of the gods in the temple of the great shogun Iye yasu. It has long been the custom in Japan to keep a monkey in the imperial stable to entertain the horses. Horse and monkey are associated, moreover, in Japanese mythology. They represent human feeling and human thought, expressed in the old proverb, "The heart is like the monkey, while the head is like the horse."

Some Adventures of Howler the Monkey

"WOULDN'T it be fun," said Peter one day, "to be a wild animal and still know as much as we do now? Just think, I could be King of the Jungle, and the lions and the tigers and the elephants would all have to do exactly as I told them."

Uncle John looked down at his nephew and smiled. It was an afternoon in early autumn, and they were both sitting on a log under a big oak tree.

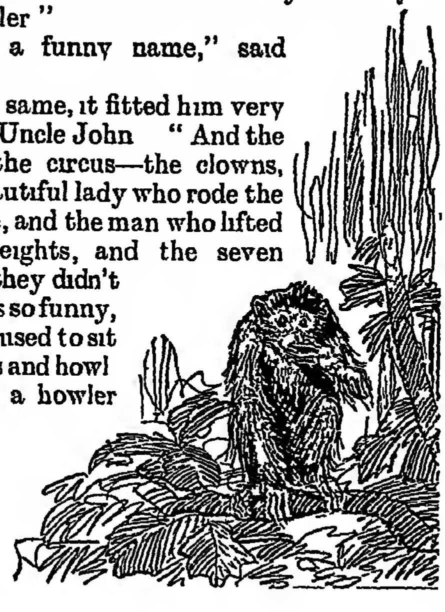
"I heard of a case very much like that once," said Uncle John. "In fact, you might say it amounted to the same thing. Only it wasn't about a little boy. It was about a young monkey. If you'll wait while I light my pipe I'll tell you the story."

Peter settled himself more comfortably and waited patiently.

"The story begins in a circus," said Uncle John thoughtfully. "And as I remember it the monkey's real name was Alouata Belzebul. At least, that's what he was called by the old man with the big round glasses who had caught him in the forests of Brazil. But mostly he was just called Howler."

"That's a funny name," said Peter.

"All the same, it fitted him very well," said Uncle John. "And the people in the circus—the clowns, and the beautiful lady who rode the white horse, and the man who lifted the big weights, and the seven acrobats—they didn't think it was so funny, for Howler used to sit up at nights and howl. And when a howler monkey howls, no one can sleep for a mile around!



One evening Howler just skipped over the rail and escaped

"'Well, anyway, crowds of people used to stand in front of Howler's cage and laugh at his tricks, for he had learned lots of clever things And Howler used to hang by his long tail from a bar and think what a wonderful fellow he must be

"But finally the circus people couldn't stand Howler's howling any longer, and he was sold to a ship's captain who admired his wonderful skill in tying knots 'He's a born sailor,' said the captain 'I'll take him to sea'

"I won't stop to tell you the adventures Howler had on board ship But he got to thinking more and more highly of himself, and one evening when the ship was anchored in the harbour of Para in Brazil, Howler just skipped over the rail and escaped In one way and another he managed to travel up the banks of the Amazon until he reached the big dark forests where the trees and vines are so thick the sunlight hardly ever reaches the ground

"One night Howler had cuddled down in a forked branch to sleep, and the big dark forest was as quiet as a church Suddenly towards morning he was wakened by the most terrible noise he had ever heard It sounded as if all the wild beasts of the whole jungle were roaring and screaming in frightful rage Howler trembled like a leaf, when the noise stopped suddenly and two dark figures laid hold of him roughly and dragged him to the top of the tree

"The sun was just rising, and Howler saw that he was in the centre of a circle of monkeys very much like himself Leaning back on a branch in the middle was an old grey-haired monkey who looked at Howler severely

"'Who are you?' he asked

"'I'm Howler from the circus,' replied the newcomer 'The man who stood in front of my tent used to tell people I was the most wonderful monkey in the world I can tie knots and I'm something of an acrobat' And Howler threw out his chest a little

"'I don't know what you're talking about,' said the old monkey, stroking his beard in a bored way 'But you say your name is Howler Let's hear you howl'

"Howler drew a long breath and let out a howl louder than any he had ever let out in his life before, but the old monkey laughed at him 'That's just a whisper,' he said 'Why don't you howl like this?' And then the old monkey opened his mouth and roared so loud that Howler nearly fell out of the tree

"'Can you travel through the trees like the wind?' was the next question

"'I told you I was an acrobat,' replied Howler

"'Then follow me,' the old monkey said, and, swinging suddenly down by his tail, he threw himself across an open space to a branch ten feet away Howler tried to do the same thing, but fell short and crashed to the ground with a tremendous thump All the other monkeys laughed long and loud When poor bruised Howler climbed back into the tree, he was told to fall in line with the mothers and children and the whole tribe started through the forest, the grey-haired one leading the way

"The next day his pride came back a little He decided he would show them all what he

"You say your name is Howler. Let's hear you howl."

could do Pretty soon he saw a herd of animals rooting around a tree They looked just like the pigs he used to ride in the circus He dropped down quickly and jumped on the back of the nearest one There was a tremendous rushing and snorting and squealing and gnashing of teeth, and Howler felt as if a hurricane had struck him He thought his last hour had come, when suddenly he was pulled upward and landed on a branch with a jolt that nearly shook his teeth loose The old grey monkey was holding him tight, while the beasts below reared up and tried to reach him

" 'Don't you ever do that again!' roared the old monkey, shaking a finger in his face 'Where were you brought up? Didn't your mother ever tell you that the peccary is more dangerous to monkey folk than the jaguar or the alligator?'

" 'I never had a mother,' said Howler meekly, 'and I used to ride pigs in the circus'

" The story of this blunder made all the monkeys for miles around laugh more than ever, and the little ones used to say 'Hallo, Howler! Have you been riding a wild pig this morning?' It drove him almost mad Everything he'd learned in the circus seemed to turn out wrong in the big forest When he pulled the tail of a sleeping jaguar, just as he used to pull the tails of the lions and tigers through the bars of their circus cages, he was only saved from certain death by a mad dash up a tall thin tree The rest of the monkeys used to say 'Oh, that's just another of Howler's foolish tricks'

" One night after the monkeys had finished their midnight song, and were starting for bed, it was found that Howler had tied the tails of all the singers together, two and two, and the knots were so tight that it took half the night to get them undone For this, Howler was chased out of the tribe entirely and had to live by himself But he used to creep around and listen to their talk, for he felt lonely One evening he noticed all the monkeys looking very sad They were gathered in small groups, whispering to one another and looking around as if they were in some deadly fear At last he managed to overhear what it was all about

Howler Ties Up the Snake

" It seems that there was a big snake—an anaconda—that had been killing and eating monkeys from that tribe for many generations He lived on a great tree near the water, and every month, during the new moon, five monkeys would disappear, and all the tribe knew they had been swallowed by this horrible snake And now the new moon was almost due

" Howler said nothing, but for two days he disappeared The third day when all the monkeys had gathered together trembling and silent Howler suddenly appeared among them

" 'Come with me,' he said to the old monkey There was something about Howler's manner that made the tribe listen They followed, and saw that he was leading the way to the snake tree by the river They wanted to turn back, but Howler called them and they followed in spite of their fear

" When they reached the terrible tree and looked down through the branches, they saw the strangest thing they had ever seen The big

One night after the midnight song it was found that Howler had tied the tails of the singers together

snake was there, lying on his usual branch, but he was absolutely helpless For winding around him and the branch was a long tough vine Round and round it went, and at the end it was tied in a big strong knot, the kind that Howler had seen sailors use in making ships fast to the wharf

" Then Howler told how he had found the snake just before he woke up from his long food-sleep and had fastened him so that he could never escape The terrible danger was over, the tribe could be happy again, and Howler was a hero The old chief called Howler to his side, and made him his adopted son And when the old monkey died, Howler became the chief and ruled wisely for many years"

" I wish I had been in his place," said Peter

" Yes," replied Uncle John " Howler came out all right in the end But still his story shows that even if you suddenly became a wild animal and knew as much as you do now, you might have to learn one or two things more before you could be King of the Jungle"

MONASTIC LIFE: PAST & PRESENT

In their devotion to religion men throughout the ages have cut themselves off from the world, living either as solitary hermits or in disciplined communities. How the monastic system grew up is described here.

Monks AND MONASTICISM The word "monk" (from the Greek *monachos*) originally meant a solitary, or one who lives alone, but in course of time it came to mean a member of a religious community Similarly the word "monastery" meant a cell or hut, and then came to mean a community of men devoted to the service of God and obeying a fixed rule

Monk in the Scriptorium

In the early days of Christianity there lived in the great Egyptian desert, called the Thebais, numbers of solitaries or "hermits" (from the Greek *eremites*, "a dweller in the desert") The most celebrated of these was Paul of Thebes, who lived towards the middle of the 3rd century These hermits were remarkable for their self-denying or "ascetic" mode of life

The first monastic organization dates from the year 305, when St Anthony established a monastery opposite the Fayum, on the Nile This, however, was not a monastery in the strict sense, as the brethren lived in separate huts, and, though under St Anthony's direction, they lived a life which was largely suggested by individual fancy The first community of monks living under a common roof was established by Pachomius in A D 340, at Tabennisi, an island of the Nile He compiled the first monastic rule The difference between the monks of St Anthony and those of Pachomius was chiefly this, that the former spent all their time in the reading of the Scriptures, in prayer and works of mortification, while the latter led an active life in which religious exercises and the reading of the Scriptures alternated with daily labour in the fields

From Egypt monasticism spread into Asia Minor and Syria, and about the year 360 St Basil established a great monastery near Neo-Caesarea, in Pontus He is regarded as the founder of Eastern monasticism, of which the famous monastery at Mount Athos is the modern representative St Basil laid down the principle that the monk must not live for himself alone, but must do good to his fellow-man In order to give his monks an opportunity to put this into effect, he established hospitals, hospices and orphanages near the monasteries under his care He also provided schools for the education of boys, not necessarily with a view to their becoming monks He discouraged excessive asceticism, and taught that work is of greater value in the monastic life than self-imposed mortifications or punishments Accordingly, the time of the monks was divided between prayer, good works, and the reading of the Scriptures

Monasticism was imported into Italy directly from Egypt at an early date, and monasteries of men and women soon became numerous throughout the Italian peninsula, especially in the neighbourhood of Rome Thence it spread into Gaul, where St Martin of Tours founded the monastery of Ligugé, near Poitiers, in 360 Even more celebrated than Ligugé was the monastery of Lérins, which gave to the Church of Gaul some of its famous bishops and saints St Patrick, the Apostle of Ireland, was trained there There is little known of Spanish monasticism before the close of the 5th century, but there were many great monasteries in Wales and Ireland Undoubtedly the chief glory of Celtic monasticism was its missionary work, the results of which are to be found all over north-western Europe

A CLUNIAC MONK

The order of Cluniac Benedictines was founded in 910 In place of the manual labour of the Benedictines, this order substituted prolonged church services The order is so called from Cluny in France, where it originated

The greatest name in the history of western monasticism is that of St Benedict of Nursia, who was born about the year 480 His "Rule" set forth the details of the monastic life in a way that had never been done before

According to St Benedict's idea, the great disciplinary force for human nature is work—the first condition of all growth in goodness The

CISTERCIAN MONKS AT WORK AS FARMERS

History records that many monasteries have been retreats for the lazy and incompetent, but these were the exception. The founders of the chief monastic orders were all convinced that idleness is a great source of evil, and have laid down rules which would entail that the monks in their establishments should be always busy—in church or study, in tending the poor and sick, or (as seen here) tilling the monastery grounds

religious life as conceived by St Benedict is therefore essentially social, where prayer alternated with the daily tasks and social duties

The influence of Benedictine monasticism was evidenced in many ways during the Middle Ages —in the conversion of the barbarians and the civilization of Europe, in the development of agriculture, in the cultivation of learning and the teaching of crafts and trades, such as painting, wood-carving, working in metals, carpentry, weaving, tailoring, the tanning of leather, and clock making English Benedictines were the greatest clock-makers of the 14th century, and one of the most wonderful clocks ever devised was the work of Peter Lightfoot, a Benedictine of Glastonbury This clock is now in the South Kensington Museum in London,

Nearly all the great orders of the Middle Ages were founded on the Benedictine plan The most notable of these were the Carthusians, so called from the Grande Chartreuse near Grenoble, in France, founded by St Bruno in 1086, the Cistercians, or "White Monks," founded by St Robert at Molesme in 1098 (now known best as Trappists), and the Praemonstratensians, or "White Canons," named from Premontre, in France, founded by St Norbert in 1120 The Benedictines were formerly known as the "Black Monks," from the colour of their habit

These monasteries were all self-contained communities, with the abbey church as the centre

In all monastic churches the plan was governed by certain common necessities (1) A choir had to be provided for the chanting of the "canonical hours" by the monks The canonical hours are fixed forms of prayer which Catholic priests are bound to recite daily, viz, matins, lauds, prime, tierce, sext, none, vespers, and compline (2) A sufficient number of altars was necessary, so that the priests of the monastery might be able to celebrate Mass at fixed hours (3) Arrangements had to be made for processions, which were held every Sunday

Cloister and Refectory

Next in importance to the church was the cloister, which was an enclosed space surrounding all four sides of a rectangular court known as the "garth" Here the older monks laboured at appointed duties, such as the copying of manuscripts and writing, here, too, the younger members of the community toiled at their studies under the direction of teachers Then came the refectory, or, as it is called, the "fratry" or common dining-hall, which was always some distance from the church Close to the refectory was the kitchen The dormitory was usually near the cloister In early times it was simply an open apartment without screens

Later, partitions were introduced, and each monk had a small room as bedroom and study

A most important feature of every monastery was the infirmary or house for the sick and the aged It was placed near the dormitory and close to the garden, or "herbarium," where herbs used in compounding medicines were cultivated The care of the sick was especially enjoined upon the superior of every monastery by the Benedictine Rule. A guest-house was a necessary part of the establishment, and near the gate of the monastery there was invariably a shelter for travellers Every religious house had an almonry, or place where the poor could receive alms, in the name of Christ To the almonry was usually attached a free school for poor boys Near the cloister there was a common-room or "calefactory" (warming place), where the monks might resort in winter to warm themselves at the common fire, which was lighted on the Feast of All Saints, November 1, and kept burning daily till Easter

Manuscripts and copied books were carefully preserved in lockers or cupboards in the church or in the cloister By the 15th century, however, libraries as we know them were common, many of them very large and splendidly arranged, with "cubicles" or small writing rooms In addition to the foregoing parts of the monastery there were numerous buildings set apart for various kinds of work, such as carpenter-shops, book binderies, forges, mills, bake-houses and barns All of these were under the supervision of a chamberlain, or procurator

All the inmates of a monastery were under the government of an abbot, whose authority was supreme Next came the prior, and then his assistant, the sub-prior

Round the Clock with the Monks

The daily life of a monastery was minutely ordered *The day between sunrise and sunset* was divided into 12 equal parts or *horae*, and likewise the night, or from sunset to sunrise, into 12 equal *horae* The hour for rising was about 2 a m On rising the monks went to the church, or oratory, for the vigils of night office, matins and lauds Meditation and other prayers followed Prime was said at sunrise, after which they went to their appointed work till 10 o'clock Tierce was then said, and from 10 till 11 30 they read Then sext was recited, followed by dinner, which was over shortly after midday The dinner, or *prandium* consisted of vegetables, possibly eggs, perhaps fish, salad, bread and wine, but no meat was allowed In Italy there followed a *siesta*, or afternoon nap, but elsewhere the monks went to the fields, the shops, or the bake-house and worked until vespers at 5 o clock Supper, or the *coena*, was at 5 30, then the reading of the 'collations,' and compline, and to bed at 6 30, often in daylight

We must distinguish "monks" from "friars" (from the French *frère*, "brother"), though both are called Religious Orders, or "Regulars," as distinguished from the "Secular" clergy Seculars are not bound by the vow of poverty as are Regulars, they follow *no special rule*, and may hold property as individuals Retirement from the world and solitude are the essential characteristics of monks, hence it is that most monasteries are far from cities or towns in some secluded spot Friaries are usually found within *or near city limits*, as the friars engage in *parochial* and other ministerial work, and come in close contact with the outside world Friars originally depended on alms or offerings of the people for their subsistence, hence the term mendicant (from the Latin *mendicare*, "to beg") was formerly applied to them The chief orders of friars are the Dominicans ("Black Friars"), the Franciscans ('*Grey Friars*"), *the Carmelites* ('White Friars"), and the Augustinians

Women Who Have 'Taken Vows'

In the early Middle Ages there were established many communities of nuns in France, Italy, Spain, England and Ireland, whose organization was, with a few exceptions, similar to that of monks Heading each community was an "abbess," who had complete jurisdiction in matters of administration Today there are many such orders of women—Sisters of Mercy, Little Sisters of the Poor, Sisters of Charity, etc —in the Anglican and Roman Churches, the "abbess" being now called the Mother Superior They devote their lives to prayer and good works, succouring the poor and nursing the sick

Monmouthshire. Along the Wye valley and between the Wye and the Usk, this English county, which has an area of 546 square miles and borders Wales on the west (it is for many purposes included in that country), has some magnificent scenery Numerous Norman fortresses were built against the incursions of the Welsh, and of these there are many remains, including those at Caldicot and Chepstow The county also has some fine monastic remains, such as Tintern Abbey and Llanthony Abbey Even more ancient is the old Roman Caerleon

In the hilly western part of the county, coal-mining and iron-working are important industries Great efforts are being made to create new industries in this part of South Wales with its vast coal reserves and port facilities, and already results are encouraging Sheep are raised in large quantities, and much land is given over to orchards Good wheat is also grown The river fisheries have been famous for centuries Monmouth (pop 4,700) is the county town Other industrial towns include Newport (pop, 84 000), Ebbw (pron *eb oo*) Vale, Abergavenny Tredegar and Pontypool The population of the county is about 43[illegible]

THE VESPER HOUR AT THE MONASTERY

What poet could better express the serenity and quiet beauty of the monastic life than the camera has here done in this view of a venerable monk meditating among the graves of the dead at the vesper hour in the grounds of a monastery in the New World?

The MARVEL *of* SETTING *our* TYPE

If this book had been printed not so very long ago, it would have been "set up," letter by letter, by hand But actually it was "tapped out" on a machine like a kind of typewriter—the monotype described here.

Monotype. To the patient monk in his "scriptorium," spending years in making a single copy of a book, printing from movable types must have seemed almost a miracle How stupefied with amazement he would have been if prophetic vision could have shown him the monotype of today which produces thousands of type each hour—cast, set, and "justified" by nimble air-breathing machines operated by simply pressing the buttons on a keyboard

Strictly speaking, the monotype is *two* machines—a keyboard "composing" machine and an automatic type-caster At the keyboard of the "composing" machine (Fig 1) an operator punches a paper ribbon into a pattern of holes This perforated ribbon, called the "controller paper," is the code of instructions to the caster When the controller paper is inserted in the caster (Fig 2), that knowing machine casts one type after another, with spaces of the proper thickness, in order to "justify" each line to the given length, it assembles one line after another and delivers them on galleys, exactly as if the type had been set by hand Unlike the linotype (*q v*), which produces solid bars or "slugs" of metal, each having a line of type characters on its face, the monotype machine casts each character separately

The monotype keyboard has more than 260 keys, because the monotype carries five or more different alphabets With those five alphabets on the keyboard, the operator can make the controller papers that enable the caster to produce hundreds of different faces of types of various sizes

Both keyboard and caster are controlled by compressed air When you touch a key on the keyboard, a complicated system of valves, pipes, levers, and punches perforates the moving paper ribbon (*See* diagram, Fig 3) Each key controls a particular combination of perforations, which is made by no other key, each set of perforations made by any key, therefore, stands for the character on that key and for no other The monotype code, however, is one of position, like the code of letters and numbers that help to find places on an indexed map

One interesting feature of the keyboard deserves particular notice This is the "justifying scale," the swinging cylinder above the keyboard, round which run row on row of figures Printed matter, as you know, must be "justified" or spaced so as to fill out each line

Fig 1 Monotype Keyboard

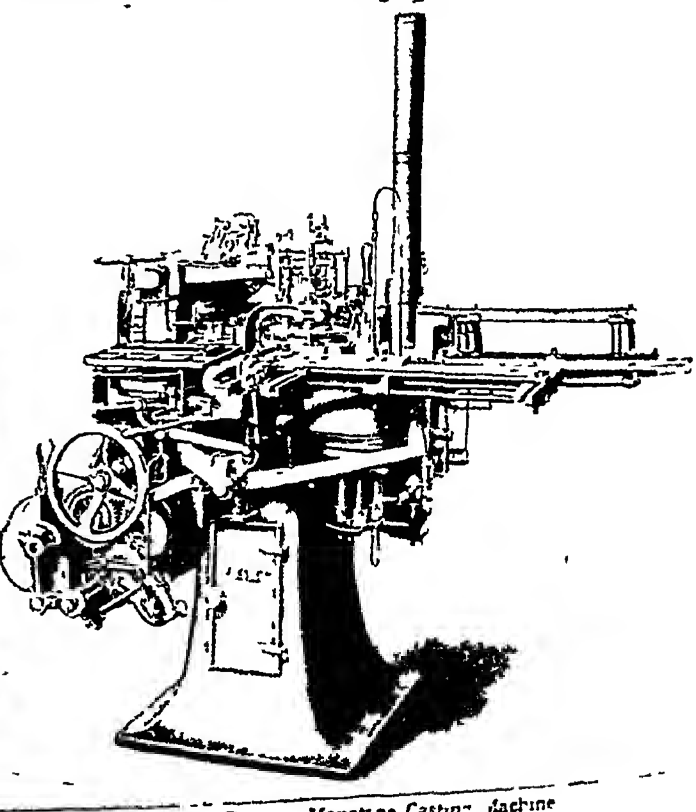


Fig 2 Monotype Casting Machine

and leave no ragged edges When the operator nears the end of a line, a warning bell rings as it does on a typewriter The operator looks at his copy and finds, let us say, that his next word (one of six letters, like "pledge") cannot be divided, and he has not enough space to put it in What does he do ?

Ask rather what the machine does The operator looks at the justifying scale, the space-pointer on it, which has been keeping watch on every letter, points to figures indicating the spacing that must be used to fill out the line The operator presses the red spacing keys at the top of the keyboard as the pointer tells him, that is all The caster, thus instructed by the perforation which this makes in the controller paper, will do the rest

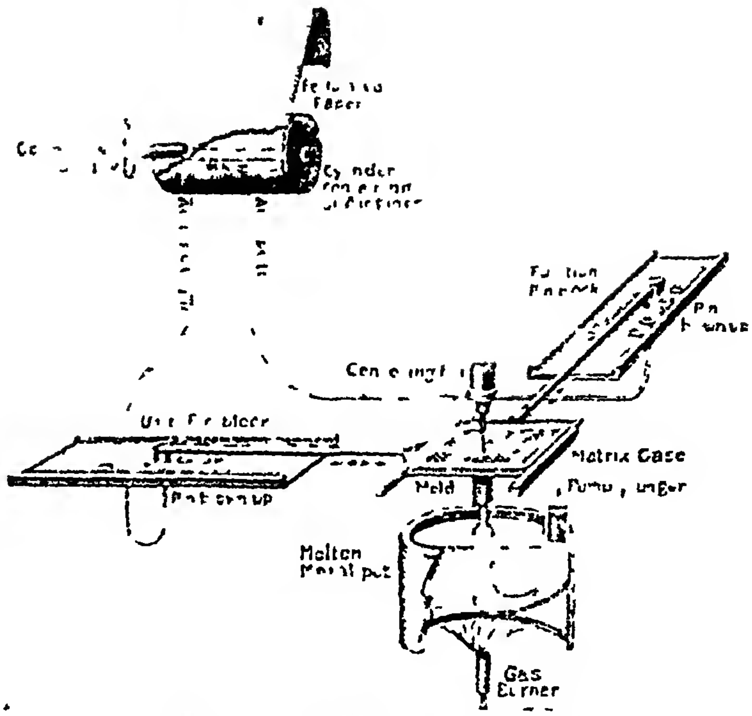


Fig 4 How the monotype caster Works

Fig 3 shows how the "controller paper" of the monotype receives its perforations When a key is pressed the valve-bar opens an air-valve, and by means of the piston, lever, and punch, one or more holes are made which stand for that letter or character Those perforations then become the instructions to the automatic caster to cast that type or character In the picture, parts of this wonderful machine are removed in order to make clear the principle on which it operates

Now let us look at the caster diagram (Fig 4) It consists essentially of the following parts (*a*) a pot of molten metal heated electrically or by a gas flame, (*b*) above the melting-pot, a mould for a single type, into which the molten metal is driven at the right instant by a pump, (*c*) face down over the mould, a matrix case (Fig 5) in which are locked 225 matrices in which the faces of the type are formed, and (*d*) a compressed-air supply, contained in a cylinder, with outlet valves which control the mechanism that does the casting

When the perforated controller paper is placed in the caster, and the machine is set going, what happens is briefly this Each set of perforations in the paper, as it comes opposite the row of holes in the air cylinder, releases air into little tubes or pipes, and by a marvellous system of pin blocks and rods the matrix case is instantly shifted so that the matrix for the corresponding letter or character is brought directly over the type mould As soon as this is centred over the mould, molten type metal

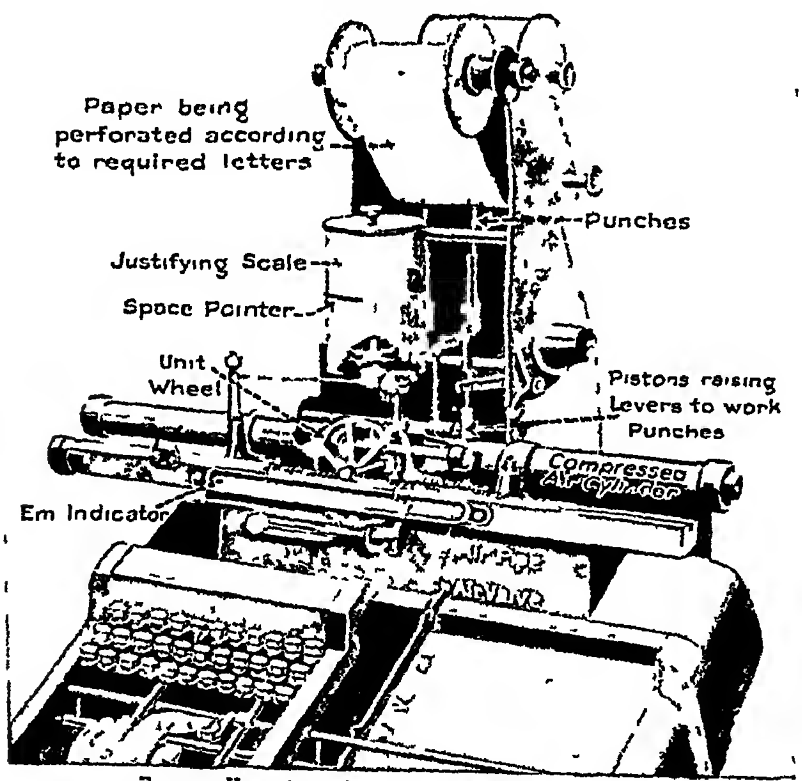


Fig 3 How the "Controller Paper" is Perforated.

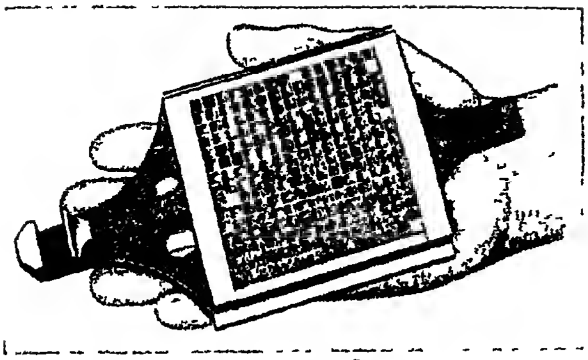


Fig 5 Matrix Case

is forced by the pump-plunger into the mould, and the type is cast Automatically the width of the type-mould alters with the size of the letter that is to be cast, so that a capital letter M, for example, will have a wider body than an I The operation of adjustment and casting is repeated as each new combination of perforations passes over the compressed-air outlets By an exceedingly ingenious arrangement the spaces between the words in each line are cast thicker or thinner, as a result of the spacing indications, so that each line of type when completed exactly fills the page or column measure

So entirely independent of each other are keyboard and caster that a keyboard in London or Manchester may prepare a controller ribbon from which a caster in Glasgow or Edinburgh may cast and set type—and set it just as well as if the two machines were in the same room And because the monotype, like the hand compositor, sets movable type, its work may be corrected or altered by hand, letter by letter, instead of having to reset a whole line as with linotype work

The monotype is better suited for setting books and magazines than for newspapers You need not look far for an example of the work of a monotype machine, for the whole of the text of this book was set up by monotype

This wonderful machine was invented and patented in 1887 by Talbert Lanston, for many years a clerk in the Pension Office in Washington, U S A Improvements and innovations are continually being made, one of the most recent being a supercaster which casts type up to 72-point, that is, large enough for using in bills and advertisements The Monotype Company have also shown themselves most progressive in reviving beautiful old types like Jenson, Garamond, Caslon, and Plantin They have also had new types specially made The type known as "Gill Sans," now seen everywhere, was originally designed for the Monotype Company by the famous sculptor, Eric Gill, who has also designed other type for them

Montaigne, Michel Eyquem de (Pron mon-tān′-ye) (1533-1592) This famous French essayist seems to be more nearly "all things to all men" than almost any other French writer His essays flow along as clearly and naturally as water He would write of his own clumsiness, of how he could not harness a horse or carve a roast or fold a letter, and what a task he found it to tell lettuce from cabbage in his garden Many a time he states ideas much more complicated and serious than his troubles with harnesses or cabbages, but always with suavity, openness to another's ideas, musing gentleness —sometimes even with a sly and cynical smile

Montaigne's training and life were extraordinary, and we perceive him, usually dressed in plain black, as a lonely, rather bitter, eccentric, and even crotchety figure He had a tower built, separate from his house, where he worked, and where he even had a little chapel and heard Mass all alone

MICHEL DE MONTAIGNE

This painting by a contemporary shows the French writer who was the first great essayist So wise and witty was he that his essays still attract fresh admirers every year

Condé Museum Chantilly photo Giraudon

Indeed, Montaigne had no very high opinion of the intelligence of women And a mocking Fate so arranged it that his six children were all girls, and it was a young woman admirer, Marie le Jars de Gournay, to whom he confided his last literary ideas, and who, therefore, became editor of his essays after his death His essays appeared in 1580 and 1588

Montana, U S A The name of this state (the third largest) is a clear indication of its principal characteristic—mountains If we could stand upon the summit of one of the lofty peaks and look about us, we should see at first

nothing but a riot of rocky pinnacles shooting out of interminable forests, then out of the chaos would come stretches of grassy plains, a glint here and there of a shining lake, and dark canyons cut by roaring cataracts Montana, indeed, is part of the great roof of the North American continent, from which waters are carried to three oceans—the Arctic, Pacific, and Atlantic

The Rockies cover the whole of the western part of the State, and in it are famous beauty spots like Glacier National Park, which adjoins Canada in the north-west There are also enormous mineral resources, and Butte (population, 39,000), in the heart of the mountains, is the centre of a great copper-mining industry Indian reservations are another interesting feature In the eastern half of the State are rich farm-lands, with huge herds of cattle and flocks of sheep The river Missouri rises not far from Helena, the State capital (population, 11,000) The total area of Montana is 146,000 square miles, and its population 537,000

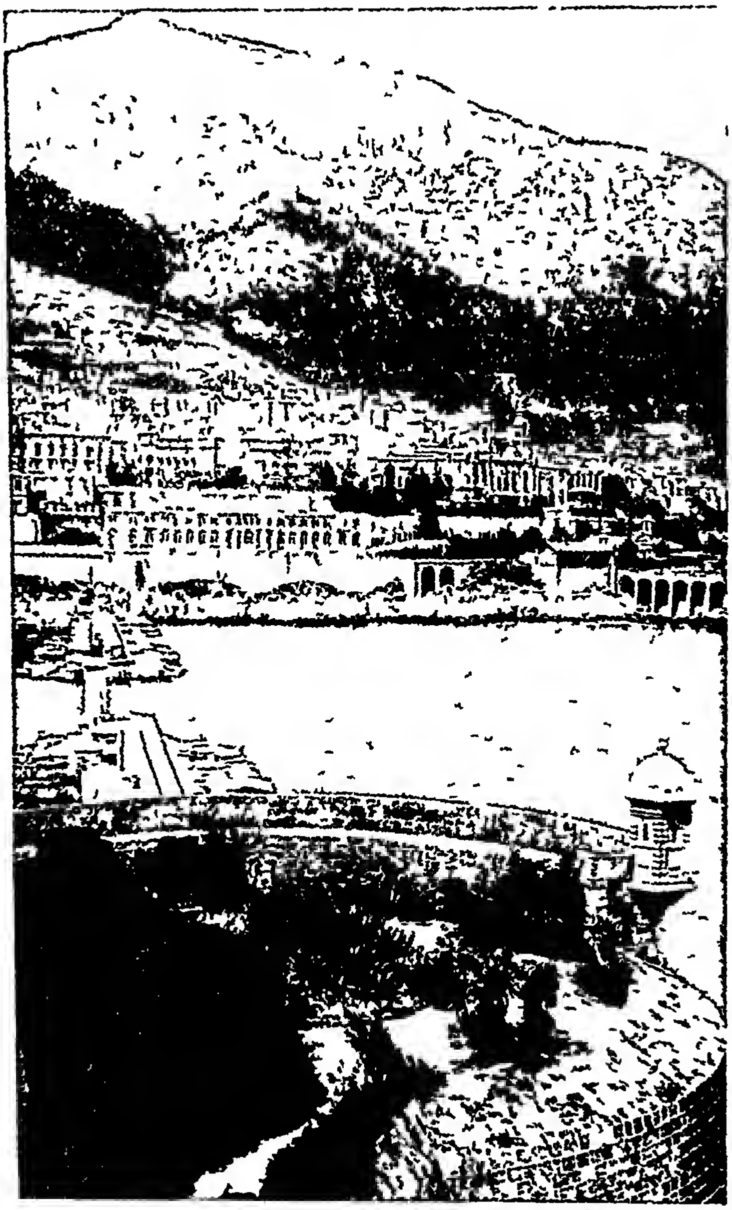
Montcalm, MARQUIS LOUIS JOSEPH DE (1712-1759) The name of Montcalm, the commander of the French troops in Canada during the Seven Years' War, is inseparably linked with that of Wolfe, the British commander, as they were the two principal actors in that drama which decided that North America was to be chiefly English-speaking and not French, and that it was the self-governing institutions of England that were to prevail and not the absolutism that characterized France under the old regime

Though Montcalm suffered defeat and death in the conflict, his name stands as high in the opinion of posterity as does that of Wolfe, his conqueror In Quebec today there stands a monument to the two heroes, bearing this inscription in Latin "Valour gave them a common death, history a common fame, and posterity a common monument"

Montcalm had entered the army of France at the age of fourteen, and risen to the rank of colonel by the time he was twenty-four Ten years later he was sent to America, with the rank of brigadier-general, to command the French troops in that theatre of the world-wide war with the British He won victories at Oswego, Fort William Henry, and Ticonderoga before the final conflict on the Plains of Abraham When wounded and told that he could not live, he replied "Thank God! I shall not live to see the surrender of Quebec"

Monte Carlo, MONACO The gleaming white walls and tiled roofs which characterize the famous Casino or gambling-hall at Monte Carlo seem almost part and parcel of the creamy chalk rock of the little triangular Mediterranean promontory near where France and Italy meet The Casino with its wide terrace fronting the sea is the centre of the life of the little city

Monte Carlo and the two smaller towns of Monaco and La Condamine, go to form



Donald McLeish

MONTE CARLO, THE GAMBLERS' MECCA

The most famous winter resort on the Mediterranean is Monte Carlo, the chief town of the little principality of Monaco Here is the town seen from across the harbour The building with twin towers across the water is the Casino, from which is derived Monaco's chief source of revenue Behind the town is the hill of La Turbie, an outcrop of the Maritime Alps

AT A 'MONTESSORI' INFANTS' SCHOOL

At modern infants' schools learning is largely practical, thanks to Madame Montessori, whose methods have revolutionized the teaching of the very young In schools run on her principles freedom is the keynote The children in this picture are performing simple domestic tasks free from strict supervision

Courtesy of the Little Felcourt School East Grinstead

the independent principality of Monaco, ruled by the Prince of Monaco His tiny realm, dotted with lovely gardens and magnificent villas, occupies the very fringe of the foot of the Alps and two promontories—only about eight square miles in total area The gambling privileges yield so large a revenue that no taxes are paid by the people of the principality None of the prince's subjects is allowed to play at the gambling tables

The town of Monaco, within its ancient battlemented walls and bastions, is reached by a tramway or by climbing long flights of steps through winding streets It centres about the palace of the Prince of Monaco, near which stand the cathedral and a remarkably fine aquarium surrounded by exotic gardens

The population of Monte Carlo is 11,000, of the principality of Monaco, about 23,000

Montene'gro. Formerly the smallest independent kingdom in Europe, and the only portion of the Balkan peninsula which was never really subjected by the Turk, Montenegro possesses a romantic interest apart from that given it by its picturesque mountains and its sturdy bright-costumed people The country lies on the eastern shore of the Adriatic Sea, just north of Albania, and the name means "Black Mountain"

The Balkan War of 1913 nearly doubled its area at Turkey's expense Then, in 1914, Montenegro came to the aid of Serbia when the latter was attacked by Austria, and as a result it was overrun by the Austro German armies It was freed in 1918 Following the close of hostilities the National Assembly voted for union with Serbia in a new Yugoslav state (*See* Yugoslavia) King Nicholas vainly resisted this act of deposition until his death in 1921

The people, who number about 200,000, are of the Slavic race, and belong mainly to the Greek Orthodox Church They cultivate small farms, and herd their flocks on the mountain pastures They have a rich literature of patriotic songs and ballads, the outgrowth of centuries of Turkish warfare The clan system, with its continuing feuds, is strong in Montenegro The pre-War capital was Cetinje, some miles inland from the Dalmatian coast

Montessori, Maria (born 1870) Most progressive schools of today emphasize liberty Pupils are given the opportunity to follow their own bents, and are urged to concentrate on the activities that especially appeal to them The credit for this forward step in education belongs to Dr Montessori, who was the first woman in Italy to be granted a medical degree, and who has given her entire life to the study of education

Liberty is the central principle of the Montessori school Dr Montessori believes that the child can develop his individuality and grow in self-reliance and in appreciation of the rights of others, only if he is allowed to work at those things which he himself chooses The teacher is not to be a dictator, but a supervisor and a guide The interest of the pupil in his work is sustained by the pleasure which he has in doing it rather than by orders, rewards, or punishments Concentration on attractive occupations develops self-control

A second characteristic of this system is emphasis on sense training Through appropriate

exercises the child learns to distinguish between various sights, sounds, feels, smells, and tastes A third point is the "exercises of practical life," through which the child learns to button, to lace, to sweep, to wash, to polish, and to perform other practical tasks

To carry out these principles Dr Montessori devised what she calls "didactic apparatus" This material is supposed to teach the child without the assistance of the teacher For example, puzzles, each piece of which can be fitted into only one other piece, teach the child differences in shape and thickness Dressing is taught by means of buttoning- or lacing-frames Writing is taught by an ingenious use of sand-paper letters

Dr Montessori devised these principles when she was principal of a school for feeble-minded children Her success with these children inspired her to try the same methods on normal children In 1907 she founded a school at Rome which she called "Casa dei Bambini," or "House of Childhood" Within a few years this pioneer was being imitated throughout the world

Many educationists hold that the Montessori method does not lay enough emphasis on the play element in education Experience, they urge, gives better preparation for practical life than does formal apparatus The imaginative side of the child is largely ignored Stories and musical interpretations are not widely used, though a few games are sometimes included

Montevide'o, Uruguay From nearly every point in this handsome city, the capital of the republic of Uruguay, one has a view of either the vast turbid stream of the Rio de la Plata—here 60 miles wide—or of the land-locked Bay of Montevideo For the city is built partly on a curiously-shaped promontory that thrusts west from the coast and partly on low hills along the shores The streets rise one above the other like a series of terraces, affording a perfect natural drainage and making the city one of the healthiest in the world All but the largest of ocean steamers are able to enter the harbour (6 sq miles in area), while the roadsteads outside offer splendid anchorages and depth for any vessel Man is likely ever to build

From any direction the view of this "City of Roses" is a lovely one Flowers are everywhere in private gardens and public parks, and along the curve of the bay are beautiful suburban residences There are many imposing public buildings—banks, theatres, government buildings, normal schools, a military college, and a university The streets are wide and laid out at right angles

Cattle the Source of Wealth

The principal industries are connected with cattle raising There are several meat-drying and salting establishments in the city Near the city are the vast abattoirs where thousands of cattle and sheep from the enormous Uruguayan ranches are killed every day, and specially prepared to be exported chilled to England Other important establishments are dairies, creameries, and tanneries—outgrowths of the cattle industry

Across the bay from the city is the conical hill from which it takes its name The population of the city is about 680,000

Montfort, Simon de (c 1208–1265) That the "Mother of Parliaments" should owe her birth to a foreigner is one more of the strange things we meet with so often in English history To this stern, and warlike knight, a Frenchman by birth, who had become Earl of Leicester in England, historians credit the origin of the House of Commons At first the English barons distrusted him because of his foreign birth On the other hand, although he had married the King's sister, he was frequently out of favour with Henry When the King sent him to govern Gascony, or Aquitaine, one of England's possessions in France, he blamed Simon for

MONTEVIDEO'S CENTRAL SQUARE

In the centre of the oldest part of the city of Montevideo is the Plaza de la Constitucion It is surrounded by clubs hotels, and business houses and a large part of one side is occupied by the cathedral seen on the right of the photograph Compared with the cathedrals of some of the other South American cities this is a modern building It was first consecrated in 1804 and became a cathedral in 1869 but the present façade dates only from 1905

violent and severe rule because of the complaints of rebellious lords

It was after the Earl had given up this task and returned to England that he became the leader of those who wished to end the King's misgovernment When the barons saw that Henry did not intend to keep his promises to reform, they resorted to arms In the first battle, fought on the downs above Lewes, Sussex, the barons were not only victorious but they also took captive King Henry and his son Edward

While Simon de Montfort exercised power he made a change in the Great Council or Parliament for which he will always be remembered In calling a meeting in 1265 he summoned not only the barons and rulers of the Church, who had always attended, but also two knights from each shire and two townsmen from each of those cities and boroughs which could be depended upon to support his reforms This is usually called the first Parliament, because it was the first in which the "Commons" (as opposed to the clergy and nobility) were represented

Soon after this meeting Prince Edward escaped from captivity and rallied about him many of the nobles who were dissatisfied with Earl Simon's harshness He showed much skill in forcing Simon to fight in an unfavourable position at Evesham in the west of England on August 4, 1265 When the Earl saw Edward's army approaching in great numbers and excellent order he said "They come on skilfully, yet it is from me that they have learned this order of battle God have mercy on our souls, for our bodies are Prince Edward's"

True to his prediction, Simon and his barons were defeated, though they fought bravely Simon himself was killed, but the reforms which he had begun were continued by the wise Prince Edward, who later became Edward I

Montgomeryshire. This inland county of North Wales, with an area of 797 square miles, is a region of hills, the highest of which occurs in the neighbourhood of the borders Perhaps the best-known of these heights are Plynlimmon (where five rivers have their source, including the Severn) and the Kerry Hills Within the county is the wonderful artificial lake Vyrnwy, which supplies water to Liverpool The beautiful river Wye rises in Montgomeryshire

Barrows and caverns abound, and there are many remains of ancient British and Roman camps It was at Machynlleth that Owen Glendower set up a parliament and was crowned Prince of Wales, and here his senate house is still to be seen

Sheep and horses are reared, and oats are the chief grain crop The Kerry Hills give their name to a special breed of sheep whose fleece is a brownish-red colour In former days much of the oak for the British Fleet came from Montgomeryshire The county town is Montgomery (population, 900) The population of the county is about 48,000

SIMON DE MONTFORT

Simon de Montfort is here depicted on his seal with his hunting-horn and hound He was the dominant figure in the opposition to Henry III, and the meeting that he called in 1265 was the beginning of the English Parliament

British Museum

Month. The word "month" comes from *mona*, the Anglo-Saxon word for moon, and its length was from one new moon to the next This is called a lunar month (from the Latin *luna*, moon) It is usually reckoned as 28 days, but the actual mean duration is 29 days, 12 hours, 44 minutes, and 2 7 seconds The lunar month is sometimes called a "synodic" month

A "solar" month is one-twelfth of the time taken by the earth for its revolution round the sun "Calendar" months differ in length, as is indicated in the old rhyme, of which one version runs—

Thirty days hath September,
April, June, and November,
All the rest have thirty-one,
Excepting February alone,
Which has twenty-eight days clear
And twenty-nine in each leap year

In computing interest thirty days are usually taken as a month, but for some other purposes 28 days (4 weeks) is the time accepted

How the Months were Named

The origin of the names of the months in our calendar is of interest January was named after Janus, the "two-faced" Roman god who guarded the gates of Heaven, and February after the Latin word *februare*, to purify Before January and February were introduced into the calendar, the Roman year had only ten months, and March (named after Mars, the god of war) was thus the first month Spring officially

begins on March 21, known as the vernal equinox, the date when days and nights are of equal length The old weather saying about this month is that " if March comes in like a lion, it will go out like a lamb "

April, month of fickle weather, derives its name from the Latin *aperire*, to open, and it certainly opens the gates to the summer months ahead (*See also* April Fools' Day) The first of May has always been a gala day, and the May Day celebrations originated in the Roman festival to Flora, goddess of flowers Today, in many villages, a maiden is still crowned with flowers as Queen of the May, and there is dancing round the maypole In many countries it is now a day of giant political demonstrations

Various Roman origins have been suggested for May, including the goddess Maia, or the word *majores*, as opposed to *juniores* (hence June) Others, however, derive June from Juno, queen of heaven, or from Junius Brutus July, we know, was named after Julius Caesar, and August after the later Emperor Augustus These two months were previously called *Quintilis* and *Sextilis* by the Romans—meaning the fifth and sixth months In the same way, September, October, November, and December were once the seventh, eighth, ninth, and tenth months respectively of the Roman year Each, of course, has its own characteristic September is the harvest month, November is the month of fogs, and so on, according, of course, to the latitudes of the zones and whether they are north or south of the equator (*See* Calendar, Equinox and Solstice)

Montreal, (Pron mon-tri-awl'), CANADA The name of this great Canadian city is derived from Mount Royal, the vast towering mass of rock rising 753 feet high from the river behind the town Montreal's first record dates from 1535, when Jacques Cartier ascended the St Lawrence and found an Indian village named Hochelaga which lay at the foot of the mountains The name is still preserved in a portion of the modern city Champlain visited the spot in 1603, and on May 17, 1642, a little band of French colonists, led by Sieur de Maisonneuve, landed on the island where the St Lawrence and Ottawa rivers meet, there to found a religious colony This was the beginning of the city of Montreal, now the commercial and financial heart of Canada, where nearly one-third of the Dominion's total trade is centred

Although nearly 1,000 miles from the Atlantic Ocean—and the channel is closed by ice for four months in each year—the city is reached by ocean-going steamers, and a system of canals and railways connects it with the Great Lakes and all parts of the Dominion On account of its situation at the break in navigation caused by the Lachine Rapids, Montreal has become the largest and most important city of Canada, and one of the greatest seaports of America It is the headquarters of both the Canadian National and Canadian Pacific Railways It ranks next to New York and New Orleans in grain shipments, and has a great number of diversified industries, including meat-packing and the manufacture of boots and shoes, railway carriages and locomotives, paper, clothing, lumber products, structural steel, etc

Montreal, which is in the province of Quebec, is built on the south-east side of the island of Montreal Behind it Mount Royal slopes up to a majestic height, and the view from the top is one of the finest in America Across the St Lawrence there is now the great Harbour Bridge

IN THE MERRY MONTH OF MAY

May, the month of flowers and dawn of summer, has been associated for untold centuries with such flower festivals as Crowning the May Queen This ceremony has always been celebrated on the first day of the month, and in this picture two " cherubs " are crowning London's May Queen of 1937

LOOKING DOWN ON MONTREAL FROM MOUNT ROYAL

A magnificent view of Montreal is obtained from Mount Royal, the fine pleasure park which lies some 770 feet above the city In this photograph we are looking out across the St Lawrence river, spanned on the right by the Victoria Jubilee bridge built in 1898–9 Like the great cities of the U S A , Montreal is now a city of skyscrapers

Courtesy of Canadian Official News Bureau

About three-fourths of its inhabitants are of French descent, but most of the trade and business is in British hands Many of the population speak both French and English, and the council proceedings and other records are kept in both languages Newspapers and periodicals are also published in the two tongues (*See* illustration in page 796)

A multitude of churches, many of them of great beauty and artistic merit, are scattered over the city The most notable is Notre Dame, facing on to the ancient Place d'Armes Chief among the many educational institutions are McGill University and L'Université de Montreal The city's population is about 880,000 there are over a million in "Greater Montreal"

Our NEAREST NEIGHBOUR *in the* SKY

Because there is no atmosphere round the moon there is no life, animal or vegetable, there , yet in some ways, not all of them understood, this dead satellite exercises tremendous power over the earth

Moon. The moon is one of the smallest of the heavenly objects, but because it is relatively near to us, and is, in fact, a "satellite" of the earth, it appears to be the largest, next to the sun, and we know more about it than of any of the planets or stars With a telescope we can actually see its mountains and ravines, its craters and broad expanses or plains, which early observers thought were seas We know the general physical geography of that part of the moon which we can see nearly as well as we know that of the earth, and all its principal mountain ranges and craters and "seas" have been named Among the ranges are those called the Caucasus, the Apennines, the Alps, and the Carpathians, some of whose peaks rise as high as 20,000 feet, among the craters are Apollonius, Archimedes, Julius Caesar, and Tycho, and among the "seas" are Mare Serenitatis (Serene Sea), Mare Imbrium (Rainy Sea), Oceanus Procellarum (Hurricane Ocean), and so on

The Moon's Shining Crescent

But such names are purely fanciful There are no seas because there is no water, or very little, and there are no storms such as ours because there is practically no air or atmosphere Indeed, we might almost say that nothing ever happens on the moon There are no winds to stir the dust, or waters to moisten it No cloud ever moves in the airless sky, no flash of fire comes from an erupting peak The land is cold and dark, and over all hangs a terrible silence

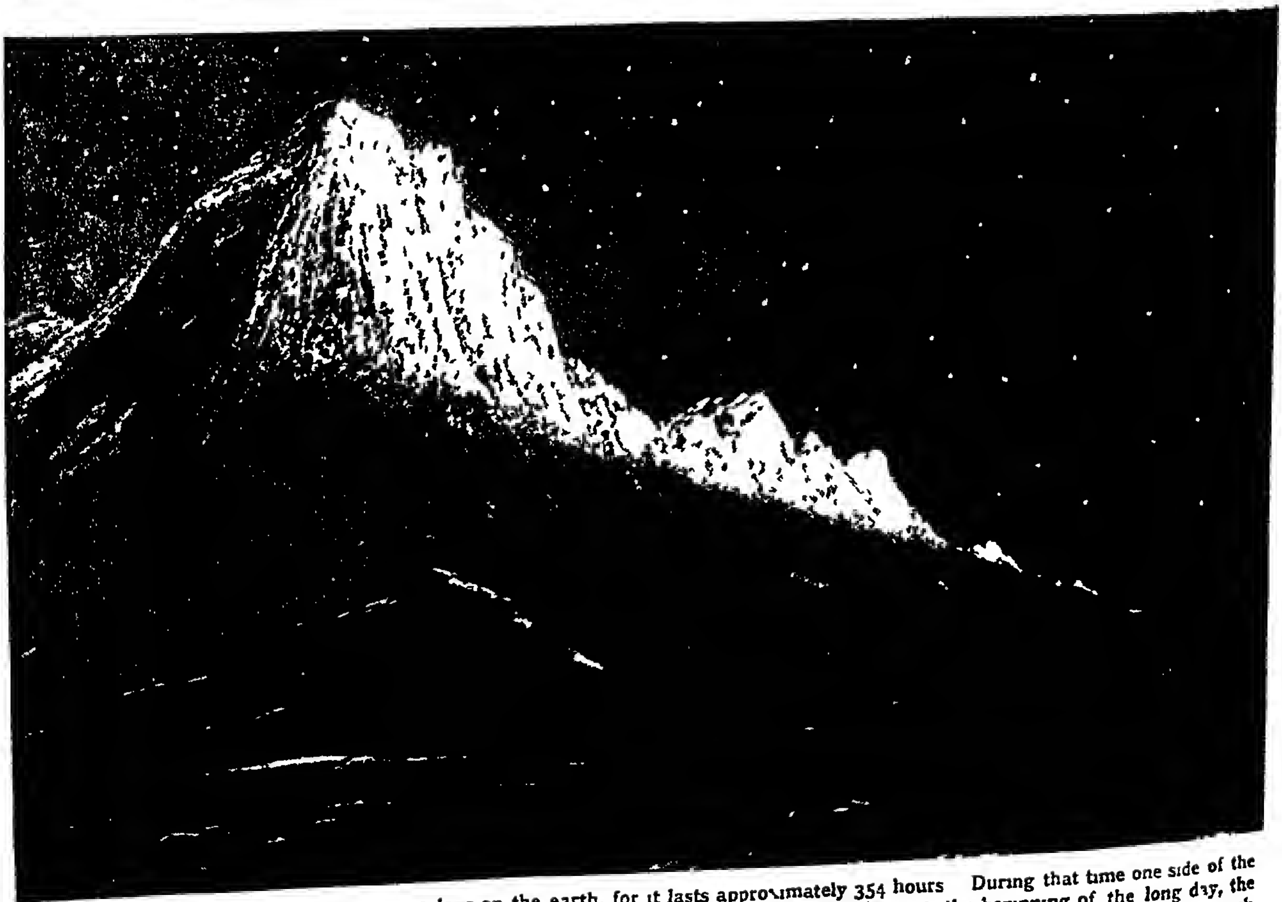
With nothing to breathe and nothing to eat or drink, human life or any form of animal life could not exist on the moon Even if it could, life would not be very pleasant there from our standpoint The lunar day—that is, the time from sunrise to sunrise—is about a month long

WONDERS OF THE SKIES SEEN FROM THE MOON

In these two drawings, based on scientific data, the artist Lucien Rudaux shows what the heavens would look like seen from the moon. Just before the sun rises, or just after it sets, the chromosphere with its red flames and streaming silvery corona is visible as in the top drawing. When at various intervals the sun is eclipsed by the earth passing between it and the moon, as in the lower picture the corona effects are even more spectacular

To face page 2796

MOUNTAINS ON THE MOON LIT UP BY SUNSHINE



A day on the moon is nearly as long as 15 days on the earth, for it lasts approximately 354 hours During that time one side of the moon is lit up by bright sunshine These two drawings show sunrise on the moon when, at the beginning of the long day, the first rays of the sun shine upon the summits of the mountains and craters As the moon has no atmosphere, the sunlight is much brighter and its heat far greater than that which reaches the surface of the earth

To face page 2797

Two weeks of blinding, scorching sun light are followed by two weeks of frigid Arctic darkness During the period of sunshine the temperature may go up to boiling point, but during the long lunar night it probably goes down to 200 and even 400 degrees below zero

In ages past the moon was doubtless the scene of violent "moonquakes" and volcanic eruptions Whether the volcanoes evolved the craters, some of which are 100 miles in diameter, is not known, they may possibly be the result of collisions with huge meteorites In any event it is supposed that the moon is now a dead planet

The area of the moon is 14,685,000 square miles Its diameter (2,160 miles) is about a quarter of that of the earth, and it would require forty nine moons to equal the earth in volume and eighty-one to equal it in weight (or mass) The moon's average distance from the earth is about 239,000 miles, whereas the sun is 400 times as far away It would take an aeroplane travelling 150 miles an hour somewhat more than two months to reach the moon

The moon is the earth's only satellite It revolves around the earth because it is held in leash by the force of gravity exerted by the superior mass of the earth The moon itself reacts on the earth, causing the tides (*See* Tide)

'HIGH JUMPING' ON THE MOON
You could certainly make a world's record for high jumping on the Moon Gravity pulls only one-sixth as hard there as it does on the earth Therefore, if you can jump six feet in an athletic contest here, your lunar leap would be 36 feet

The phases of the moon—"new," "half," and "full"—result naturally from its various positions with respect to the sun and earth The moon is "new" when it is between the earth and the sun, it is "full" when it is on the side of the earth away from the sun Solar eclipses occur only when the moon is new, and lunar eclipses when the moon is full (*See* Eclipse)

The Vast and Shining Solitudes of the Moon

WHO is not moved by that picture of the moon which Sir J A Thomson has given us? We may say of the moon, in his words, that "it was earth's only child, and it died!"

Several different theories have been advanced as to the origin and history of the earth-moon system One of the most interesting of these was advanced by Sir George Darwin, who sought to show that the moon and the earth were originally one mass and that they have come to their present state through the influence of the tidal action of each on the other According to this theory the earth, it is said, was once shaped like a pear, and as it spun round the small end of the pear broke off and spun round independently For ages and ages it went round the sun side by side with the earth, but slowly it got farther away, until at last it is where it is, as far away from us as ten times round the world This happened, it is said, millions of years ago, when the earth was cooling down from its molten state and a crust about 30 miles thick had been formed, and the part which broke away equalled about 5,000 million cubic miles of matter

A more recent theory teaches that the moon was formed by the drawing together of a great number of small masses about a larger one which attracted the smaller ones by reason of its greater mass These small masses were probably of the same sort of material as those from which the earth and other planets were

built up In all probability the earth and the moon were formed in the same way, at the same time, of material which came originally from the sun as the result of some cosmic explosion

The pull of the earth on the moon and the pull of the moon on the earth have never failed, and today they travel together and revolve together, so that the other side of the moon has never yet been seen by anyone on earth But we know, from the face that we see, that the moon has had an amazing history since it was first formed The sun pours down its light and heat on it unceasingly through a day 300 hours long No life like ours could exist in the heat that reaches the side turned to the sun, but on the opposite side the moon is always as cold as ice, and no life like ours could endure a cold like that A man living on the moon would spend his long day in the tropics and his long night in the Arctic He would have to endure alternately such heat and cold as human beings have never known

Intense Darkness and Cold

No atmosphere envelops the moon, so the fierce heat of the sun pours down on it unchecked There is no blanket to break its heat, no ocean of air to diminish its intensity or soften its dazzling light And as there is no atmosphere, there is no " sky light," so that the sun shines on the moon from a dense black sky It would look like a great white ball shining in pitch-black night When the sun withdraws its light and the moon is wrapped in night, the darkness there must be as in the darkness of a pit A day and a night on the moon are equal to a month on earth, so that for 14 of our days a man of the moon would live in light and heat unknown to us, and for another 14 days in unimaginable blackness and cold

We can hardly think of a world like that as anything but dead, and if the moon was born when the earth was born we may ask why it has died so soon

Why is the earth covered with green trees, and carpeted with flowers, and throbbing with the life of a myriad living things, while the moon is dead and bare ? It is because the moon is smaller If the earth were small like the moon, our air would gradually be left behind as the earth travelled through space With the air would go our water, and with air and water gone, no life would be possible on earth We would have the same great heat of the lunar day, the same extreme cold of the lunar night

On the moon, all life and water and air have passed away, all sound has gone If we should shoot an explosive rocket against the moon, its impact would be silent, for sound is carried by air, and over the moon's surface, as between it and the earth's atmosphere, there is an almost perfect vacuum

Weird and strange indeed are the scenes on this dead world, and it is one of the triumphs of the human mind that we know them well Long before we knew the North Pole of the earth men knew the North Pole of the moon Men find their way about the moon by telescope almost as easily as about the earth It was the first thing Man began to study in the heavens It is these craters that seize a man's imagination They are the handwriting on the moon They are gigantic beyond anything seen on earth, and the forces that made them are beyond our understanding There are hundreds of them, and from some of them vast quantities of matter have been flung for more than 20 miles Their walls rise up miles high, and some of them are so wide that two men standing one on each side would be fifty miles apart The walls rise sheer like walls of houses, but they fall away outside, and for a hundred miles at times we can trace the vast extent of those tremendous forces which flung up burning lava in molten streams from the furnace of the moon These craters, according to one theory, are the remnants of volcanoes, but to what can we compare the mighty cataclysms which tore the very heart of the moon to pieces and left it yawning with chasms and stricken with death ?

It is believed that sometimes, in these explosions on the moon, a single eruption may have sent forth, crashing out of the red-hot depths, hundreds of cubic miles of matter In some craters there are gaps across the surface a mile wide and 150 miles long, and deeper than from the top of our highest mountain to the bottom of our deepest sea, or more than ten miles below the surface

And, as chasms are deeper and craters wider, so mountains are higher on the moon A grain of mustard seed on a globe three feet across would represent the highest mountain on the earth, but a grain of seed on a globe one foot wide would stand for the highest mountain on the moon Cliffs are much steeper than on the earth, and the mountain scenery, if we could see it as we see the Alps or the Rocky Mountains, would be far grander than our own

The Moon and Our Tides

Perhaps you have not thought of it, but as the sun keeps our atmosphere in constant circulation through the winds, so the moon does with the waters The power of gravitation runs from moon to earth and earth to moon, and the pull of the moon on the sea brings the tides up on the shore twice a day A hundred years ago at London Bridge the rising waters as the tide came in, the rushing river as the tide went out, were made to work pumps that carried water to London people This power of the tides was one of the good things of the past that men stopped instead of building up The

BARREN WASTES OF THE LUNAR LANDSCAPE

This striking photograph was taken with the 100-inch reflector at Mt Wilson The picture shows the moon in natural position, and not upside down, as it would be seen through a telescope The smooth area in the centre is the Mare Imbrium (Rainy Sea), bounded below at the right by the Apennines The shallowest and most prominent of the three craters at the right near the mountains is Archimedes Directly above Archimedes, on the margin of Mare Imbrium, is the black ring-like plain known as the crater Plato If you look closely in the lower left-hand corner you can make out the dimly outlined crater Copernicus, one of the hugest of all It is 46 miles across and is rimmed in by mountains 12,000 feet high. The smaller crater to the right and above Copernicus is Bullialdus

time may come when we shall build it up again, and then all men who toil will bless the moon, for it will be the slave of earth chained to our factories, turning wheels, driving our machines

Moore, Sir John (1761–1809) Although Sir John Moore had a distinguished career as a soldier, it is the manner of his death which has made his name live on in history

He saw service in America during the War of Independence, then fought against the Irish rebels, in the Netherlands, and in Egypt before being knighted and promoted lieutenant-general In 1806 he was sent to the Mediterranean as second-in-command, and two years later led a division in an unsuccessful attempt to help Sweden

Returning home, he was immediately sent out to Portugal, and became, soon after the Convention of Cintra, supreme commander of the British forces against Napoleon in the Peninsula He had to move his troops to Salamanca, in Spain, to assist his Spanish allies, but was compelled to retreat in face of enemy superiority in numbers The port chosen for embarkation was Corunna, in the extreme north-west, and Moore's retreat to the coast over 250 miles of difficult country in midwinter has become a classic of British military history

In a last victorious stand, actually at Corunna, on January 16, 1809, Moore was mortally wounded, and he died the next day Charles Wolfe's famous poem, "The Burial of Sir John Moore," graphically describes the scene at the gallant general's graveside

SIR JOHN MOORE

Sir John Moore fell in a victorious rearguard action at Corunna in 1809 He was buried on the field of battle, and the scene is described in a famous poem by an Irish poet, Charles Wolfe, "The Burial of Sir John Moore," written seven years after Moore's death

Painting by Sir T Lawrence National Portrait Gallery

Moors. When the Arab armies swept across northern Africa in the 7th century, they found in the north-western corner of the continent a white race of ancient origin called the Berbers These they converted to Mahomedanism after a sharp struggle at the beginning of the 8th century Then Berbers and Arabs joined in invading and conquering Spain, and a mixed race sprang up called the Moors

The name Moor comes from the Latin *Mauri*, the name for the Berber inhabitants of the old Roman province of Mauretania, now Morocco It is applied today chiefly to the people of mixed blood inhabiting the sea-coast of the Barbary States The typical Moors of Morocco are a handsome race, with olive skin, black eyes, and black silky hair The women are beautiful in early youth, but grow fat rapidly, a quality much admired by their own people The Moors are courteous and intellectual, but also cruel and revengeful Of the pirates who infested the Barbary coast in former days, these mild-mannered cut-throats were the most feared

The Moors reached the height of their power in Spain After the conquest of the Visigoth kingdom in 711, and a period of great disorder, the famous Arab caliphate of Cordova was formed which lasted until 1031 Following the collapse of the caliphate, the Moors (Berber-Arabs) who had obtained control of north-western Africa crossed to Spain and wrested the power from the pure-blood Arabs

After the battle of Navas de Tolosa in 1212, in which Alphonso VIII of Castile broke the Moorish power in central Spain, the Moors still ruled the kingdom of Granada, which rose to a splendour rivalling the former caliphate of Cordova It was not until 1492 that the power of this Moorish kingdom, weakened by internal discord, was shattered by the armies of Spain

The Moors were then expelled from Spain, to the great economic and intellectual loss of that kingdom A number of them adopted Christianity and remained in Spain About 60,000 of their descendants, called Moriscos, dwell in Spain today Many remains of the days of Moorish greatness are still found in Spain, chief among which is the Alhambra palace at Granada (*See* page 140)

Moose. The largest living deer common to the northern regions of the Old and the New World is the elk or moose, for the latter is merely the American counterpart of the European elk The elk is found right across the Old World from Scandinavia to Siberia, and the moose is found from the United States northwards It has long legs, and a big bull stands six feet high, it has a huge head with broad muzzle and large nostrils The average weight is about seven hundred pounds, while unusually large specimens attain twice this weight

MONARCH OF NORTH AMERICA'S FORESTS

Here he stands an Alaskan Bull Moose, the most powerful wild animal of North America When he's in a hurry, he simply pushes his way through the underbrush, overthrowing any small trees which stand in his way He fears no forest foes for he is a match for anything except the huntsman's rifle and is a fierce and courageous fighter Specimens such as the one shown attain weights as great as 1 400 pounds, and boast antlers measuring six feet from tip to tip Moose are found chiefly in Maine Minnesota, northern Michigan and Canada

The moose can easily be distinguished from all other deer by the magnificent antlers of the male, which sometimes attain a spread of more than six feet. Each antler is like a broad hand, with the palm curved and held upward, and with the margins set with prongs. An average full-grown pair of antlers, with the skull, weighs seventy pounds. They grow gradually; the first year they are knobs an inch high, the second year they grow to about a foot in length, and the third year they take on their palm-shaped character. The fully formed horns are shed in December and sprout in April, reaching their full size in June. It is remarkable to think of these enormous horns being shed annually and produced again in so short a time.

The moose feeds on willow-tips, on the slender shoots of the striped maple and other trees, and on bark and various evergreens. It often wades in water up to its neck, to escape flies and mosquitoes and to feed on succulent water-plants. When enraged a bull moose strikes vicious blows with its front feet as well as with the heavy antlers, and is a dangerous foe for Man or beast. Moose are rapid runners, and have a sharp sense of hearing and of smell; as a result they are difficult to hunt. In winter they herd in small troops for protection.

Morayshire, SCOTTISH COUNTY. Washed by the broad waters of the Moray Firth, this county was formerly called Elginshire for all official purposes, although the natives often referred to it as Moray, a Gaelic word meaning "among the seaboard men."

Comprising just over 475 square miles, with a population of about 41,000, the county is one of the finest farming districts in all Scotland. Favoured with a rich soil, equable temperature both in winter and in summer, and a moderate rainfall, its lowlands yield big harvests of wheat, barley, and oats. Live-stock breeding is another profitable side of farming, large numbers of the famous Aberdeen-Angus beef cattle and Leicester and Black-faced breeds of sheep being reared. Other industries are whisky distilling, sandstone quarrying, and deep-sea fishing, the fleets of Findhorn, Burghead, Hopeman and Lossiemouth (where Britain's first Labour Prime Minister, J. Ramsay MacDonald, was born) being among the oldest in the herring, haddock, and cod fisheries of the North Sea. There is much natural beauty in Moray, particularly among the Cromdale Hills and along the courses of those famous salmon rivers, the Spey, Findhorn, and Lossie.

Elgin (population 8,000), the county town, on the Lossie, five miles above Lossiemouth, is of great antiquity and historical interest. Its castle housed Edward I of England in 1296 and 1303, in his campaigns to subjugate the Scots, and the cathedral of Moray, founded in 1224, was almost destroyed in 1390 by the "Wolf of Badenoch," as a son of King Robert II of Scotland was styled. Elgin manufactures woollens, tweeds, and plaid cloths and has several good distilleries.

More, SIR THOMAS (1478-1535). "I say no harm, I think no harm; but I wish everybody good," once declared Sir Thomas More, the great English statesman, scholar, and author. This was no idle boast, for the man who made it was a lovable merry man, with warm affections and a kind heart. Among his children he was a loving companion, and often he would take scholars and statesmen into his garden to see his girls' rabbits. And yet this kindly genial man wished it engraved on his monument that as Lord Chancellor he was "the scourge of thieves, murderers, and heretics."

Son of a prominent London barrister, young Thomas More was reared as a page in the household of Cardinal Morton, who prophesied greatness for his ward. As a student at Oxford, More came under the influence of the New Learning, and later formed a close friendship with the great Dutch scholar, Erasmus, who was captivated by his charming personality. He speaks of More's home as "school and exercise of the Christian religion. No wrangling, no angry word was heard in it; no one was idle; every one did his duty with alacrity and not without a temperate cheerfulness." These two, with John Colet, the distinguished Dean of St. Paul's, were the leaders of a group of scholars and religious reformers in England since known as the "Oxford Reformers," who did much to promote the Renaissance in England.

Entering his father's profession of law, More early attained distinction; but for a time religious piety led him to fast, pray, and scourge himself as a preliminary to entering the priesthood. He finally gave up this plan, but the religious motives remained supreme in his life, and every Friday he scourged his body as penance for sin.

More's Rise to Power

In 1504 More earned the enmity of Henry VII by opposing, as a member of Parliament, the King's exorbitant demands for money aids. The accession of Henry VIII brought More, almost against his will, into high place at court. The young King was attracted by the rising lawyer's learning, wit, and geniality, and employed him on various embassies. He knighted him, promoted him to various official posts, and on Cardinal Wolsey's fall from power, in 1529, More was made Chancellor—the first time that the office had been held by a layman.

When it appeared that Henry had resolved on a divorce from his queen, Catherine of Aragon, More, as a loyal churchman, resigned his office on the plea of ill health. He refused to acknowledge

SIR THOMAS MORE IN THE TOWER OF LONDON

Here are Sir Thomas More and his daughter, gazing out the window upon a party of monks being led to execution, during the stormy times when Henry VIII broke with the church of Rome Sir Thomas, formerly Chancellor of the kingdom, had been imprisoned on a charge of treason when he opposed Henry's move His family urged him to acknowledge Henry's supremacy, but he stood fast On the occasion which this picture illustrates, he characterized the monks as " blessed fathers who were going as cheerfully to their deaths as bridegrooms to their marriage," and it was in this spirit that he met his own fate

From the painting by J R Herbert

Henry's claim to be head of the English Church, and for this defiance the King had More—together with Bishop Fisher and others—committed to the Tower on a charge of treason Against the pleadings of his favourite daughter, Margaret Roper, his wife, and his friends, More stood firm, and on July 6, 1535, he was beheaded

Even in his death More's wit did not desert him Climbing the scaffold where he was to die, he said to the officer in charge " I pray you see me safe up , as for my coming down, let me shift for myself " When the axe was about to fall he asked the executioner to wait a minute until he had pushed his beard aside, observing, " Pity that should be cut, which has never committed treason "

More is famous as the author of " Utopia," a romance written in 1516 " Utopia " (meaning " *nowhere* ") *is the name of an imaginary island* which More represents as the abode of a happy society, free from all cares, anxieties, and miseries All men are equal, and everyone may worship as he chooses None is allowed to become rich through the oppression of others, property is held in common, and all are required to perform the same amount of labour The book had a political object, for the evils which it depicts as remedied in Utopia are those which then afflicted England From the title of this book we get the adjective " utopian," which is applied to plans for the improvement of society that are considered visionary and impracticable In 1935 More and Bishop Fisher were canonized —the first English saints to be created since the breach between Henry VIII and the Pope

Morgan, Sir Henry (*c* 1635-1688) While still a young lad, Henry Morgan was kidnapped at Bristol and sold as a slave in Barbados, eventually joining the pirates who then had their headquarters in Jamaica

His first important expedition was as a ship's captain in the attempted capture of Curaçao in 1666 When his chief, Edward Mansfield, was captured and put to death by the Spaniards, Morgan was elected " admiral " by the buccaneers His career after this made him the most feared man on the Spanish Main

Two successful expeditions led by Morgan, with a full commission from the Governor of Jamaica, are worthy of particular mention These were the sacking of Panama in 1668, and, in the following year, his capture of the town of

CAPTAIN MORGAN DEFEATS THE SPANIARDS

Like many pirates, Henry Morgan gained fame at home primarily for his privateering activities against his country's enemies, for he rarely attacked ships belonging to England or her allies In this old woodcut his ships are seen defeating the Spanish fleet off Maracaibo in 1669 He then held the town, on the Venezuelan mainland, to ransom and sacked it, obtaining a rich haul of gold plate, jewels and silver

Maracaibo (now in Venezuela) and subsequent astonishing escape from the pursuing Spanish fleet Morgan was sent home in disgrace in 1672, but managed to find favour with King Charles II, who sent him back to the West Indies as Colonel Sir Henry Morgan, Lieutenant-Governor of Jamaica Morgan died at Port Royal

Morgan, JOHN PIERPONT (1837-1913) J P Morgan was certainly born " with a silver spoon in his mouth," but it was entirely due to his own business genius that he rose to create and control the greatest commercial corporation ever known—the U S Steel Co

He was born at Hartford, Connecticut April 17, 1837, and began his career in a bank Morgan was only 34 years of age when he became a partner in a financial house that soon became the biggest in America He headed the Atlantic shipping combine, and was instrumental in restoring stability after the "crash" of 1893

Morgan was a princely donor to charities, and became the greatest art collector in the world After his death direction of his undertakings devolved on his son (born 1867), who bears the same name The firm of J P Morgan & Co acted as the American agents of the British Government during the World War

Morley, JOHN MORLEY, VISCOUNT (1838–1923) With the death of Lord Morley on September 23, 1923, there passed away a great figure in statesmanship and literature, one who may be called the last of the philosophic Radicals, the doctrinaire Liberals of the school of John Stuart Mill His ideas were expressed with such sincerity that he was called "Honest John"

But it is perhaps as a writer rather than as a statesman that Lord Morley's name will go down in history His literary masterpiece is undoubtedly his "Life of Gladstone," but close on its heels come his essay "On Compromise" and his masterly studies of Burke and Cromwell, and of Voltaire, Rousseau, Diderot, and other great Frenchmen

Unlike so many other literary men of rank, Morley was a brilliant conversationalist So much so, indeed, that Lady Oxford, herself no mean exponent of the art of wise, witty conversation, has recorded in her memoirs that John Morley far outshone in this respect any other public or political figure

The son of a Blackburn surgeon, Lord Morley was educated at Cheltenham and Oxford He read for the Bar, but soon took to journalism Among other papers, he was editor of the "Fortnightly Review" and the "Pall Mall Gazette," and he also edited Macmillan's "English Men of Letters" series, in which his own life of Burke appeared

Lord Morley was twice Chief Secretary for Ireland, and in 1905 became Secretary of State for India He was raised to the peerage in 1908 as Viscount Morley of Blackburn, and in 1910 became Lord President of the Council, from which office he resigned in 1914, on the declaration of war against Germany In 1902 he became an original member of the Order of Merit

Mormons. The term "Mormons" is really a nickname for members of the Church of Jesus Christ of Latter-Day Saints, an American religious sect

Joseph Smith (1805–1844), founder of Mormonism, received his first heavenly manifestation, it is said, at the age of 14 Other visions followed, including those which revealed to him the Book of Mormon, which purports to be a record of the early inhabitants of America—three groups of people, one of whom had come from Babylon at the time of the confusion of tongues, and the other two from Jerusalem about 600 B C He organized the Church of Jesus Christ of Latter-Day Saints with six members at Fayette, in New York State, in

1830 Missionaries were sent out and branches were started in various states and in Europe Following trouble with non-Mormons, the Mormon leaders were thrown into gaol at Carthage, Illinois On June 27, 1844, a mob stormed the gaol and killed Joseph Smith and his brother

The Mormons then decided to go to the Far West On their thousand-mile trek to the valley of the Great Salt Lake, one of the notable migrations in history, they were led by Brigham Young (1801–1877) They arrived in July, 1847 This first band of Mormon pioneers, who founded Salt Lake City, consisted of 143 men, three women, and two children Because they had introduced the practice of polygamy among about four per cent of their membership, the Mormons were once the subject of much notoriety Since 1890, however, the policy of the church has been against plural marriages

In many countries, including Britain, Mormon missionaries are at work, and there are still ignorant people who fear that these young men and women are chiefly engaged in enticing young girls to go to Salt Lake City, to be married to some Mormon elder possessed of several wives already!

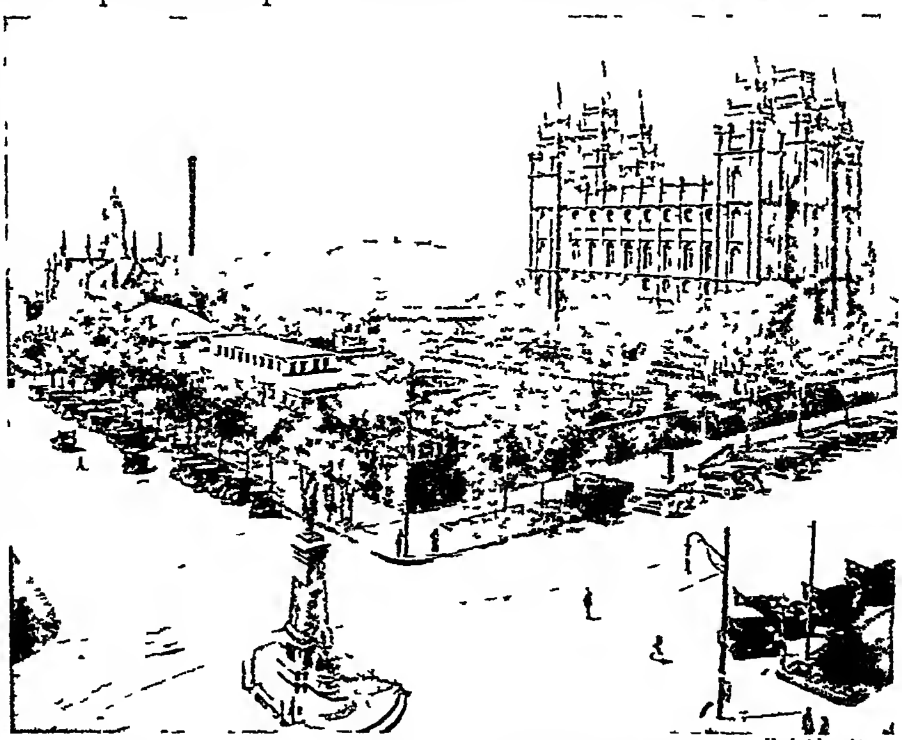
Moroc'co. During the opening years of the 20th century the Mahomedan country of Morocco, in the north-west corner of Africa, was a perpetual menace to the peace of Europe Bounded by Algeria, the Mediterranean, the Atlantic, and the Sahara, and with an area about the size of France, it was a land of great agricultural possibilities, and with unknown mineral wealth But never was realm so amazingly misgoverned as this independent sultanate There was practically no law except the Sultan's whim He appointed a horde of greedy ministers or viziers, who in turn appointed governors of provinces, who in their turn selected the town officials and village sheiks No salaries were paid The lesser officials grabbed what they could by bribery and extortion from the poverty-stricken population They were then forced by the higher officials to disgorge a great portion of their loot, whereupon the Sultan extracted the lion's share from these latter The decisions of judges in the "courts of justice" were bought and sold the man who bid the highest was always right

Powerful bandits were allowed to infest the country In 1905, for instance, the notorious Raisuli captured Ion Perdicaris, a naturalized American citizen and demanded about £14,000 ransom In this case the Sultan of Morocco was compelled to pay the ransom himself

Morocco as a Bone of Contention

The rival interests of European powers—France, Germany, and Spain especially—gave rise to what was called "the Morocco question" France came to be regarded as having special interests in the country because of the dangers to French capital invested and to French rule in Algeria from the continued anarchy in Morocco In 1905 Germany suddenly demanded a reconsideration of Moroccan affairs, and her threat of war produced a conference of the powers at Algeciras in Spain in 1906

Then, in 1911, Germany again brought Europe to the verge of war by sending her gunboat Panther to Agadir (on the Atlantic coast), in violation of what France considered to be her right in the country France and Germany were almost on the point of mobilization when Great Britain let it be understood that she would



MORMON TEMPLE AT SALT LAKE CITY H J Shepstone

The Mecca of the Mormons is Salt Lake City, in the State of Utah U S A., and the 10-acre enclosure seen in the photograph holds all that is most sacred to members of the Mormon faith In it are the Temple the building with six tapering pinnacles on the right, the Tabernacle with its curious domed roof beside it and the Assembly Hall on the extreme left In the foreground is the Pioneer Monument surmounted by a bronze statue of Brigham Young

support France, and Germany stated that no threat was intended In this way the matter was easily adjusted and Germany agreed to recognize a French protectorate over Morocco, in return for the cession to Germany of a large area of French territory in central Africa The aggressive party in Germany remained dissatisfied, however, and the war cloud of 1911 helped to produce the whirlwind of 1914

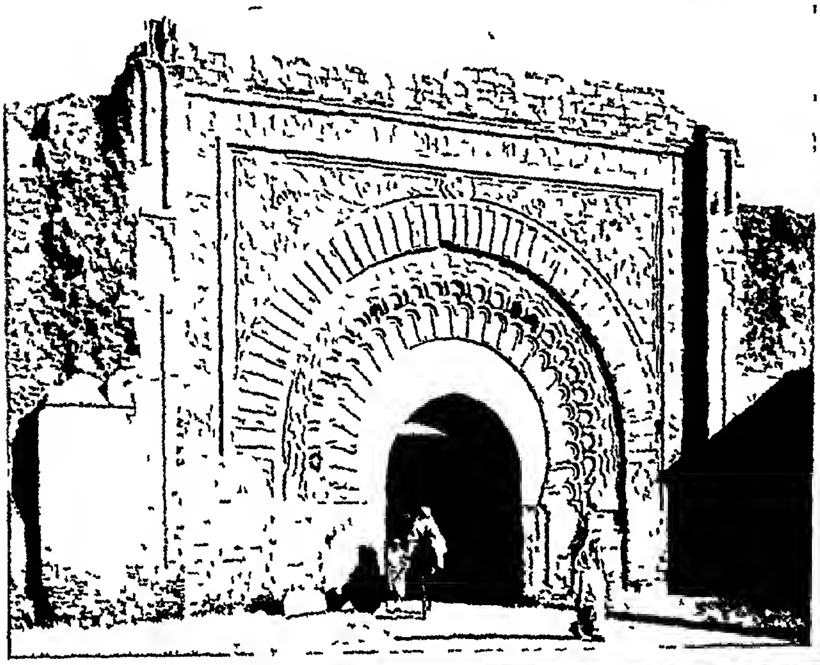
The French protectorate in Morocco is still in force, but there are also a Spanish zone in a strip running 200 miles eastward from the Strait of Gibraltar, and an international zone round the port of Tangier Certain tribes known as the Riffs, led by Abd el Krim, gave much trouble after the World War until their commander surrendered to combined French and Spanish forces in 1926

The Sultan of Morocco resides in the French zone—normally at Rabat, but sometimes at Marrakesh or Morocco (population 190,000), Fez (144,000), or Meknes Casablanca (258,000) is the largest city The effective government is in French hands, with a Resident-General at the head In the Spanish zone the Sultan's powers are given to a Khalifa, chosen by the Sultan The principal town in the Spanish area is Tetuan (49,000) The total area of Morocco is estimated at 213,350 sq miles (of which 200,000 sq miles comprise French Morocco), and the total population at over 7,000,000

Morocco is divided into two parts by the Great Atlas Mountains, which sweep parallel to the sea-coast from the Atlantic to the east coast of Tunis Jebel Ayashi (14,600 feet), the loftiest peak in northern Africa, rises in central Morocco Protected from the hot winds of the desert by snow-clad summits, the Moroccan seaboard has a delightful and healthy climate, but the regions beyond the mountains suffer from intense heat in summer and bitter cold in winter

The country produces great quantities of grapes and nearly all kinds of European and tropical fruits Grain growing is on the increase, wheat, barley, oats, and beans having been added to *dura*, the native millet Sheep, goats, cattle, and horses are raised in great numbers The future of Morocco is believed to lie in its rich mineral resources

The inhabitants consist chiefly of Berbers, Arabs, and Jews The Berber mountaineers are the hardiest, most numerous, and most industrious of these people The



IN TWO MOROCCAN CITIES

The top photograph shows a weather-worn gate of Marrakesh one of the three imperial cities of Morocco Many gates quite as beautiful as this grace the walls of the city, but they have been allowed to fall into a state of disrepair The photograph below shows a market street in Fez, the capital of Northern Morocco The latticed roof serves to keep off the heat of the midday sun

Photos top Felix bottom E N A

mixed population of the coast towns are known as Moors, and are mostly descendants of the Moslems who were driven out of Spain in 1492 The large Jewish population also traces its origin to the Spanish exiles of an earlier period

In ancient times Morocco was known as Mauretania, and its early Berber natives were subjects first of Carthage and then of Rome In 429 the country was overrun by the Vandals, who introduced the system of piracy which lasted for fifteen centuries

In 682 the Arab armies, carrying the green banner of Mahomet, seized Morocco From that time forward a long and confused contest for supremacy went on between the Berber chiefs and the Arab descendants of Mahomet At one time the rule of the Sultan of Morocco was extended right across the Sahara Desert to Timbuktu, but later the anarchy and disorder set in which persisted down to the period of French occupation

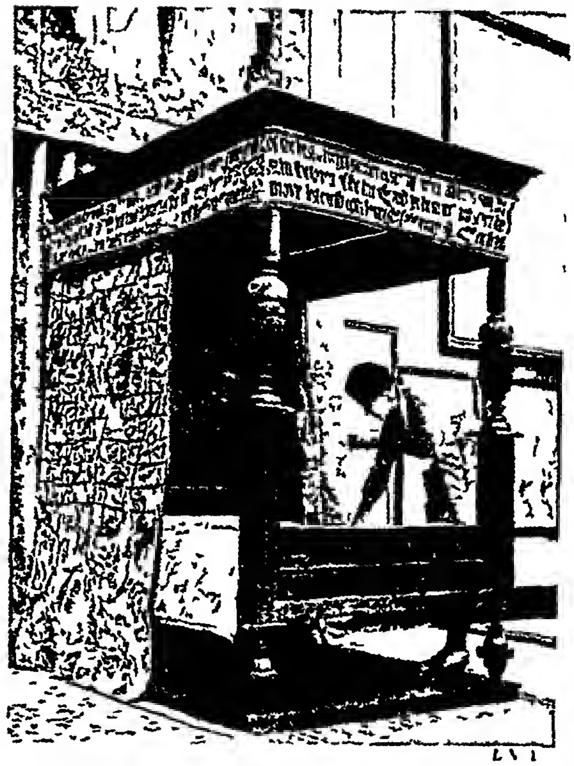
In the Middle Ages Morocco was a centre of learning and of industries The city of Fez had a university as early as 859 Morocco leather, made of goat skins, was highly prized, and is widely imitated to this day

Morris, William (1834–1896) "A man should put his heart into his work, and that work should be the kind that he can care about" This was the creed of the English poet and artist, William Morris, a practical dreamer of extraordinary energy and versatility who had a strong influence upon the literary, artistic, and social life of his time

The young Morris was remembered by schoolfellows at Marlborough as "a thick-set strong looking boy, with a high colour and black curly hair, good-natured and kind, but with a fearful temper", a strange boy, fond of doing things with his hands, of taking solitary strolls, and of telling long stories of knights and fairies

During quiet Oxford days at Exeter College he began a life-long friendship with Edward Burne Jones Both Morris and his friend early developed a passion for a remote ideal beauty, particularly that of the Middle Ages Then, together with Dante Gabriel Rossetti, the poet-painter, and Edward Millais, Morris and Burne Jones founded the group called the Pre-Raphaelites (q v)

In 1859 Morris came out of his remote dream-world in which he had been trying his hand at poetry, architecture, and painting, and married Jane Burden, a noted beauty whom he had often painted Not wanting any of the fashionable, clumsy, overtrimmed, gilded, and befringed house furnishings for their home, this true lover of beauty began to design his own As a result of this, Morris and his colleagues founded an establishment for making household furniture and beautifully designed and coloured



DESIGNED BY WILLIAM MORRIS

This old four-poster bedstead was used by William Morris at Kelmscott Manor, his home in Oxfordshire—where, indeed, it still is The embroideries were designed by William Morris and worked by his wife and daughter The verses on the valance were written by Morris

curtains, rugs, tapestries, wall-papers, and even stained-glass windows

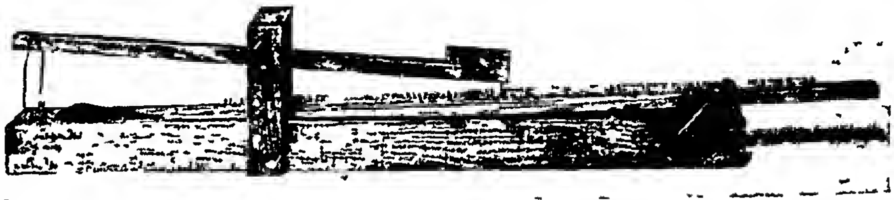
Later, at his famous Kelmscott Press at Hammersmith, Morris turned out many beautifully printed and illuminated books Among these were a number of his own, for Morris all his life was a writer of fluent and often beautiful poetry and prose

In his later years Morris came more and more to realize that the social world was "out of joint," and did what he could to "set it right" and make the world more beautiful for all He became an active Socialist, and preached the gospel that work that brought no joy was fit only for slaves Throughout his life Morris may be said to have overworked himself on behalf of others He died October 3, 1896

Among Morris's works are "The Defence of Guenevere" (1858), a book full of picturesque ballads, "The Life and Death of Jason" (1867) "The Earthly Paradise" (1868–70), a volume of dreamy romantic narrative poems on classic and medieval themes, and "News from Nowhere" (1891), an account of a Socialist Utopia which is supposed to be established in Britain in the not-far-distant future

Morse, Samuel (1791–1872) "I wish that in one instant I could tell you of my safe arrival but we are 3,000 miles apart and must wait four long weeks to hear from each other"

Samuel Finley Breese Morse, a twenty-year-old homesick youth, wrote this sentence in a letter to his mother in 1811 She was in the old home in Charlestown, Massachusetts, U S A, and he had gone to London to study art Perhaps it was at the moment of writing that letter that young Morse first conceived the desire to bridge space with flying words—a desire which was later to give the world the electric telegraph



MORSE AND HIS TELEGRAPH

This portrait of the famous American inventor, S F B Morse, depicts him at the receiving end of his telegraph The tape in his hand bears a tracing of a message in the Morse Code The lower picture shows the transmitting key Type for each letter of the code was placed in the stick, and as this was drawn along the lever was raised and lowered, making electrical contacts

From a replica in the Science Museum South Kensington

His life was one long record of courage, integrity, patience, and faith, of poverty and struggle nobly endured in the pursuit of worthy ends Courteous, studious, with his father's dignity and his mother's gracious manner, he commended himself to his teachers and fellow students He showed deep interest in chemistry and physics, especially in electro-magnetism, but art was his chief concern, and by the age of forty Morse occupied a high place in it

But all this time his love of science was struggling in the back of his mind When, in 1832, he was returning from Europe in the steamship Sully, there happened to be several men who were interested in electricity During a discussion one day Morse suddenly suggested "If the presence of electricity can be made visible in any part of the circuit, I see no reason why intelligence may not be transmitted by electricity" As he sat on deck he worked out his plan in a series of drawings and explained them to his fellow passengers With a few minor changes, the instruments he devised that day became the models for the ones which he later patented and which are now in use the world over

Morse arrived back in New York a successful artist, with commissions awaiting him, and a life of honour and wealth before him But he chose to disappear into a little shop in New Haven and live through years of poverty, obscurity, toil, and ridicule in pursuit of his scientific vision He lived alone in his shop, sleeping on a camp-bed, cooking his own food, often going hungry In 1837 he applied for a patent on "The American Electro-magnetic Telegraph," but the "wild scheme" was thought impracticable

He went to England, France, and Russia seeking aid for his invention, but failure met him at every step After almost superhuman efforts he eventually induced the United States Congress in 1843 to vote sufficient capital to build a line from Washington to Baltimore In May, 1844, the first message was flashed over this wire

The inventor's labour of years was crowned with success From that time on the growth of the electric telegraph was rapid Although other men of science, both before and after 1837, in Europe and America, worked at the problem, Morse's system became the basis of most land telegraph systems The code of dots and dashes he invented is still known as the "Morse code" (*See* table under Telegraph) The first attempt to lay an Atlantic cable was made in 1857 by Morse and Cyrus W Field Four cables parted, but the fifth was laid in 1866 (*See* Cables)

Mosaic. (Pron mō-zā'-ik) Few things show better how men love the beautiful than their efforts to make the floors, ceilings, and walls, even the pavements, of their homes and temples artistic This may be seen best in mosaic work, which consists of designs in coloured stones or glass made by using small pieces fitted together and held in place by cement The pattern or picture thus becomes practically indestructible

This art was known to the Assyrians and Egyptians, and flourished during the palmy days of Rome It was revived later, especially in the art of the Byzantine Empire (*q v*),

it came into great popularity again in Italy during the middle of the 13th century There has been a revival in modern times, and the demand for mosaic is steadily increasing

Florentine mosaic, used chiefly for jewelry, personal ornaments, and paper-weights, is composed of shells or stones of natural colours cut in much smaller pieces than are employed in Roman mosaics

Tesselated mosaics, used chiefly in floors, such as the famous one uncovered at Pompeii, are made of small cubes of marble, glass, or terra-cotta nicely pieced together Such pavements, in fact, were a usual part of the typical Roman villa, and many have been unearthed in all parts of Britain

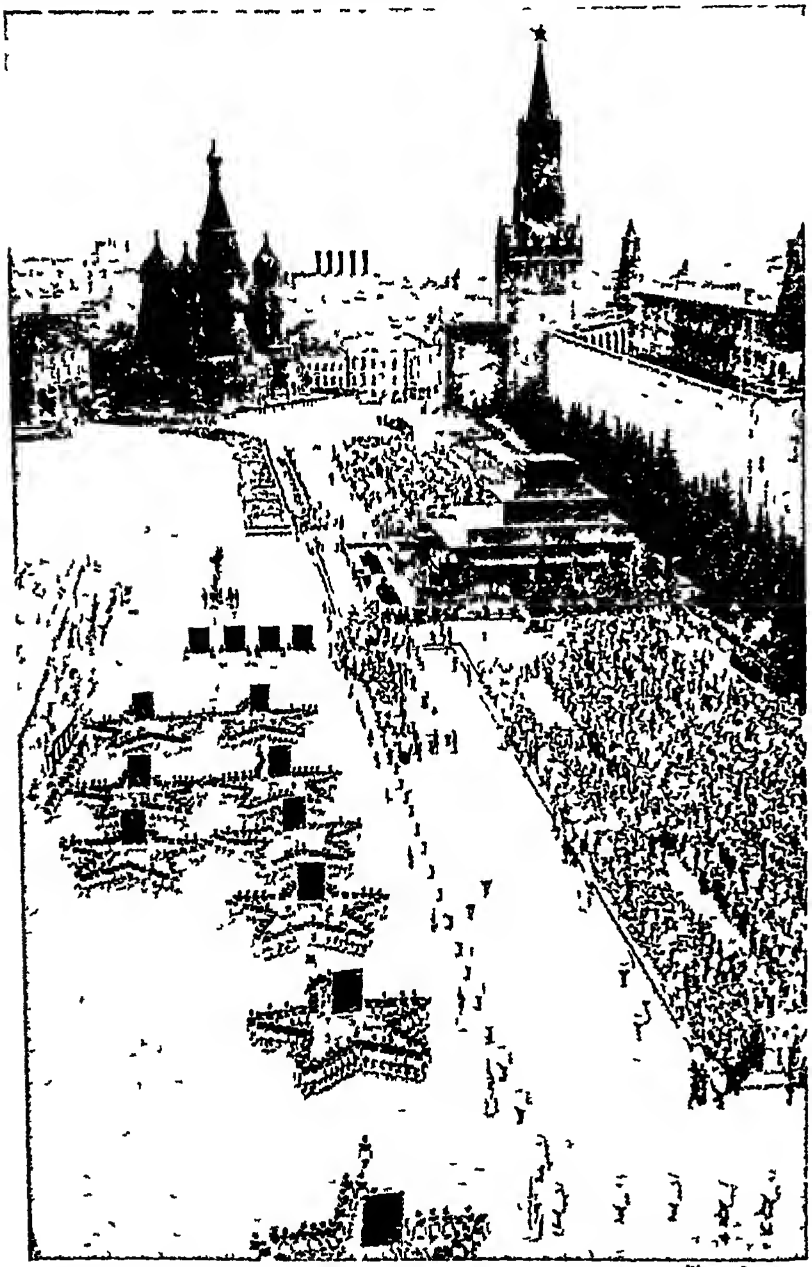
Moscow, Russia "Holy Mother Moscow" was the centre about which the old Russian empire grew up Now it is the capital of the vast Union of Soviet Socialist Republics, and also the capital of the Russian Socialist Federated Soviet Republic, a unit of the U S S R

To the Russian millions Moskva, as it is called in Russian, is no longer "Holy Mother" because of the anti-religious drives of the revolutionary leaders The old walled monasteries, the hundreds of churches with their bright and bulbous domes, the turreted palaces, the myriad bells that pealed their devout hymns at evening—these gave Moscow its individuality But most of the churches now have been converted to other uses, or torn down to make room for new buildings, and the bells now play popular songs

There are business blocks of great sky-scrapers built in the bold, rectangular German style, and on the outskirts are row after row of modern buildings to accommodate the tremendous increase in population since the Revolution However, Moscow still has many of the towers and bulging cupolas which make it look like a dream city

Dominating the city are the pink walls and battlements of the Kremlin The word *Kremlin* means a citadel It is an imposing city in itself—a large triangle enclosed in walls about sixty-five feet high There are nineteen towers and five gates, the loveliest, perhaps, is the Gate of the Redeemer, which in the old days was a shrine no man might pass without removing his hat In this tower the bells of a clock strike the hours, and twice each day ring out the "Internationale"

The Kremlin was the legal residence of the Tsars and the Vatican of the Russian Church Now it is the seat of the Soviet government, whose officials reside in the former imperial palace A huge building,



Planet News

YOUNG RUSSIA IN MOSCOW'S RED SQUARE

This photograph shows the Red Square of Moscow where 40,000 athletes from the eleven republics of the Soviet Union are giving a display to celebrate the 20th anniversary of the Revolution The square stone building on the right is Lenin's tomb, standing in front of the grim walls of the Kremlin while in the centre is the former Cathedral of St Basil

known as the Palace of the Soviets, is under construction in another part of the city this will house the government offices Within the walls is an array of historic cathedrals and convents, sacred relics, big guns and cannon, tombs, and priceless collections of jewels and works of art

East of the Kremlin is the Kitai Gorod, or Chinese city It is so called because the Mongols built the wall surrounding it Next to the Kremlin, it is the most ancient part of Moscow It was once the residence of the merchants, just as the Kremlin was the residence of the aristocracy Red Square, which was called "Red" long before Russia became Red Russia, is in the Kitai Gorod For centuries the square has been the centre of Russian political events It was repeatedly used as a camp by the Mongols was a forum and place of execution under the Russian monarchs, and under the Soviet government it is the centre of national demonstrations and processions Its buildings are now occupied chiefly by government offices Dominating the square is the squat, strangely imposing Lenin mausoleum, where crowds wait in long queues to view the khaki-clad body of their former leader The top of the mausoleum is used as a platform for public orators Three of the principal streets meet here, as do most of the city's bus and tramway routes

Planet News

ON MOSCOW'S UNDERGROUND

One of the achievements of the Soviet government of Russia is the building of an underground railway in Moscow, the first section of which was opened in 1935 It is remarkable for the elaborate decoration of the stations, as may be seen from this photograph of the platform of Kievskaya station with its marble pillars, and floor inlaid with mosaic

One of the most noteworthy buildings in the square is the Cathedral of Saint Basil, built by Ivan the Terrible in the 16th century Legend says the Tsar had the architect blinded so that he could never reproduce its 12 painted domes, some twisted some scaled, each topped with a heavy cross It is now a museum Moscow guards everything of educational or artistic value It has many museums which schoolchildren visit regularly Homes of the former aristocracy have been converted into schools, hospitals, or day nurseries The city is proud of its artistic productions—its lavish opera and ballet and the drama of the Moscow Art Theatre and Great Academic Theatre

Always an important centre of trade, Moscow is now a meeting point of the great Russian railways and of air routes connecting with the principal cities of Europe and the Orient An underground railway, or "Metro," was opened in 1935 A canal has now been completed linking Moscow with the Baltic the Black Sea, the White Sea, the Caspian, and the Sea of Azov

Moscow's history as a city dates back to the 12th century It was the capital of all Russia from 1480 to 1711, when it was superseded by St Petersburg (Leningrad), and regained the position in 1918 The most striking event in its troubled history occurred during Napoleon's invasion in 1812, when the burning of the city forced the French to begin the disastrous "retreat from Moscow"

The population of Moscow in 1937 was 4,137,000

Moses. Among all lawgivers there is one supreme name, that of Moses, the great leader and lawgiver of the Hebrews The story of his life as told in the Bible is full of wonders In the land of Egypt, where his people were held as slaves, the cruel Pharaoh ordered that every male child born to the Hebrews should be cast into the Nile But Moses' mother put her little son in a box made of bulrushes and laid it in the reeds by the river's brink Then Pharaoh's own daughter found him there and cared for him Thus Moses was saved for his destined work of delivering his people from cruel oppression and of founding a nation

From Egypt Moses led his people through the Red Sea and the desert wilderness to Mount Sinai Here, according to the Biblical account, amidst flashes of lightning that enveloped the mountain top, God gave to Moses the Ten Commandments, written upon two tables of stone These laws, often called the Decalogue

(from the Greek *deka*, ten, and *logos*, word), formed the foundation of the civil and religious laws of the Hebrews (Exodus xx, 2-17) They turned the people away from the idolatry that they had learned from the Egyptians to a purer faith and a higher moral order In these simple commandments are the fundamental elements of all moral law, and they have had a tremendous influence not only on the Jews, but on mankind as a whole

Moses, who had led the people for 40 years in the wilderness, did not live to see them established in the Promised Land, but through the laws which he gave them and the ideals he held before them, the little wandering band of shepherds was transformed into a nation, destined to bring moral and spiritual light to the world

Among the heroes of the nations, few exhibit such a combination of strength and spiritual nobility as Moses He had the courage to defy the great Pharaoh of Egypt, and yet he was "very meek, above all men that were upon the face of the earth" He led his people "as a father carries his child"

The first five books of the Bible—Genesis, Exodus, Leviticus, Numbers, and Deuteronomy—or the *Pentateuch* (meaning "five books"), are sometimes called the five books of Moses, from the fact that their authorship was attributed to Moses Among the Jews they are known as the *Torah*, or law, because they contain the Mosaic law They tell, too, the story of Moses' life

MOSES IN THE DAY OF BATTLE

This picture illustrates the Bible story of Moses ensuring the victory of the Israelites, under the leadership of Joshua, over the Amalekites When Moses held up his arms the Israelites prevailed and when he let them down the Amalekites prevailed Towards the end of the day Moses strength failed, and his arms were supported by Aaron (left) and Hur

From the picture by Sir John Millais P R A Manchester Art Gallery

Mosley, Sir Oswald Ernald Born November 16, 1896, eldest son of Sir Oswald Mosley, Bart, the leader of the British Fascist movement entered Parliament as Conservative M P for Harrow in 1918, but, dissatisfied with the policy of his party, he detached himself from its ranks and sat as an Independent from 1922 to 1924 In the latter year he joined the Labour Party, being returned M P for Smethwick Although he lost his seat in the 1924 general election, his forceful personality and his brilliant oratory rapidly established his reputation amongst his new colleagues He was re elected for Smethwick in 1926, and in the second Labour Government held cabinet rank as Chancellor of the Duchy of Lancaster

A growing contempt for what he described as the "spineless apathy" of the Socialists led him, in 1930, to sever his connexion with the Labour Party, and to found the New Party But in spite of his energy it failed to prosper, and, when it became clear that Mosley was inclining more and more to Fascism, the handful of M P s who had joined him from the Socialist, Liberal, and Conservative ranks, left him He stood as a New Party candidate at the general election of 1931, but was defeated

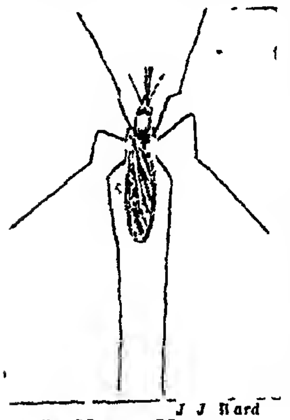
Almost at once he re-formed the relics of the New Party under the title of the British Union of Fascists He visited Italy to study Italian Fascism (*q v*), and on his return closely followed Continental methods His recruits, who became known as Blackshirts from their uniform (made illegal by the Public Order Act, 1936), were largely young men, who became involved in many ugly "scenes" with Communists Passions were raised to fever heat in the East End of London when the Fascists embarked on an anti-Jew campaign

In 1928 Mosley succeeded to the family baronetcy He married, in 1920, Lady Cynthia Curzon, who died suddenly in 1933

MAN'S MOST DEADLY FLYING FOE

War in the air is a great deal older than the invention of aeroplanes, for (as is told here) the battle between Man and mosquito has been raging for years. We also learn of the mosquito's cousin, the tiresome gnat

Mosquito. It is probably true that the weapons of the malaria-carrying and yellow-fever-carrying mosquitoes have claimed more victims among mankind than the swords and spears of all the conquering warriors of history.



The Malaria Mosquito

Until recent years no one suspected that the mosquito was one of the root causes of the evil reputation of many of the fair and fertile lands of the tropics, where so many white men lost their lives.

When De Lesseps and his gallant army of French engineers undertook to cut a ship canal through the Isthmus of Panama, it was the mosquito rather than the magnitude of their task which totally defeated them. De Lesseps and his force attacked the Isthmus like a besieging army, but the mosquitoes drove them back. The engineers returned again and again to the assault, only to be mown down relentlessly by diseases spread by these tiny insects.

Not only did the European explorers, missionaries, traders, soldiers, and officials, whose duties took them into tropical lands, suffer and die from malaria and yellow fever, but the natives of these countries also succumbed to these mysterious diseases by thousands every year. For centuries both maladies were regarded as inevitable. Even the doctors had no idea how these diseases were caused. They were put down to the climate. Yet the very mosquitoes that were to blame, instead of being recognized as the cause of the spread of disease, were also taken for granted in these climes.

Precautions in the Tropics

Residents, both European and native, in tropical lands regarded the mosquito as an unavoidable affliction which they had to put up with. The natives filled their huts with smoke to drive away the mosquitoes, and the Europeans covered their windows and doors and screened their beds with mosquito netting in order to obtain protection.

It was the mosquito's bite, and the painful swelling which followed, that they tried to avoid; they never imagined that the mosquito was a distributing agent of deadly disease.

It was Colonel Sir Ronald Ross of the Indian Medical Service, who in 1898 discovered the malaria-carrying powers of one kind of mosquito. Following the work of Sir Patrick Manson, he thus opened up a new field of knowledge, which later made possible the discovery that yellow fever was carried by another species of mosquito.

It was not an accidental discovery. For years Colonel Ross had been dissecting and examining mosquitoes under the microscope in an Indian hospital before he found the tiny parasite in the stomach of a mosquito, which he proved was responsible for malaria.

Further experiments showed that the malaria mosquito (*Anopheles*) is not the cause of malaria in one sense, but when it sucks the blood from a person suffering from malaria it takes into its own system the malaria parasite and transfers it to another. This discovery paved the way for the further discovery by Dr Walter Reed in 1900, that yellow fever was similarly transmitted by the *Stegomyia* mosquito.

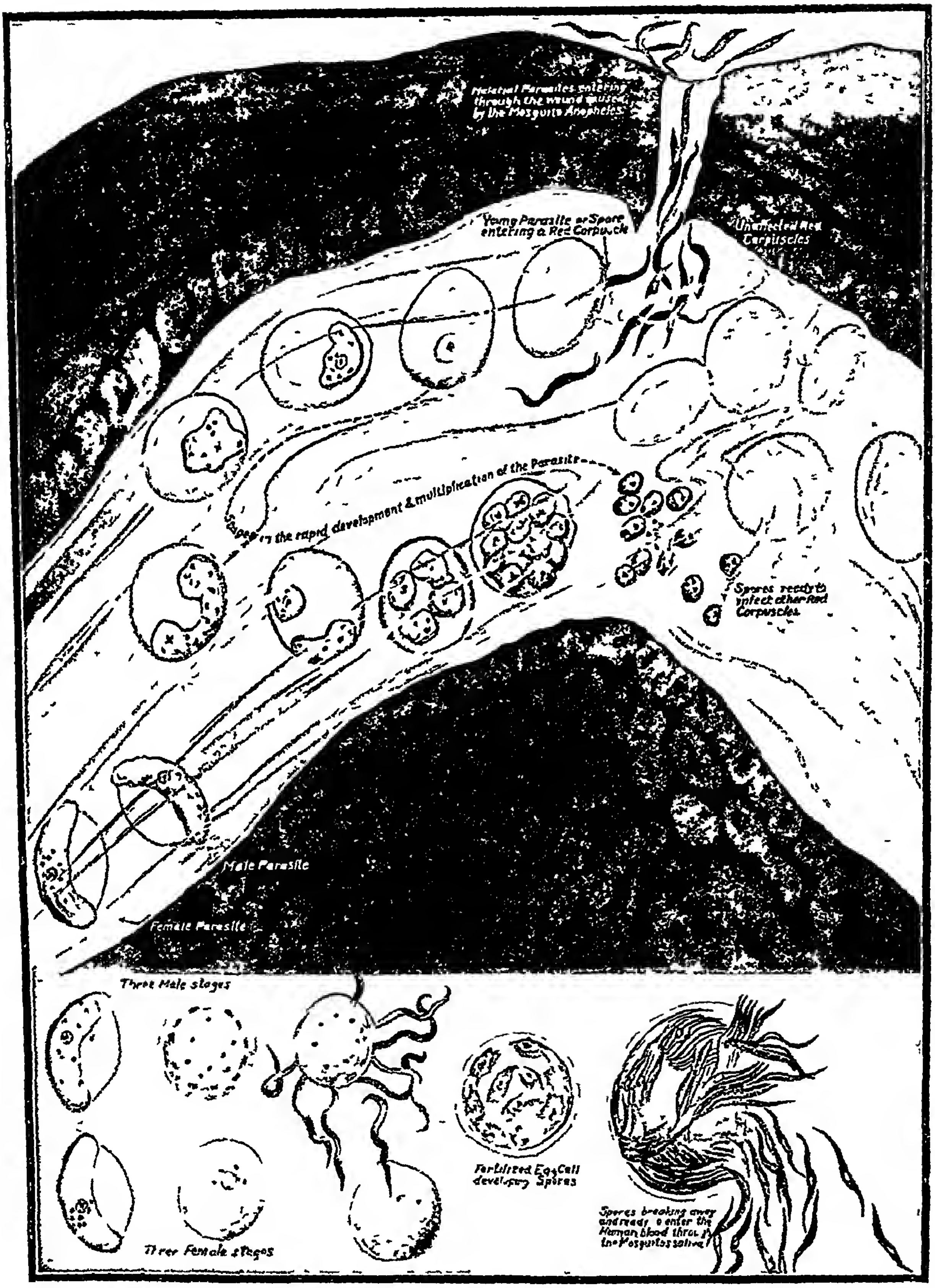
Life-Story of the Mosquito

The mosquito lays its eggs in floating, boat-like masses on any still water, from puddles in the road or domestic water-butts to large lakes. The larvae emerge and wriggle about in a very lively fashion. They breathe through their tails, and as they have to do so by thrusting them through the surface, it is possible, by putting paraffin all over the surface of any water, to drown the larvae. This is still a recognized way of controlling mosquitoes. The pupae, too, swim about by means of leaf-like appendages at the tail-end of their bodies. In due time the perfect insect emerges on the surface of the water, and when its wings are dry it takes to the air. In biting a victim of malaria, it gets into its own system the parasite causing the disease and it passes this on to the next person it bites.

We do not, luckily, suffer much from the malaria mosquito in this country, though there were times when such marshes as those along the south bank of the Thames, where now is situated Battersea Park, were among its breeding haunts. But in places on the Continent a very great battle has had to be fought against the insects. Thus, in Italy, the marshes between Rome and the sea were uninhabitable for hundreds of years because of the mosquito plague; now they have been drained and are quite healthy to live in.

Gnats are in many ways almost exactly the same as mosquitoes, and are much more common in Britain. Both belong to the same group of the true flies, and you would probably

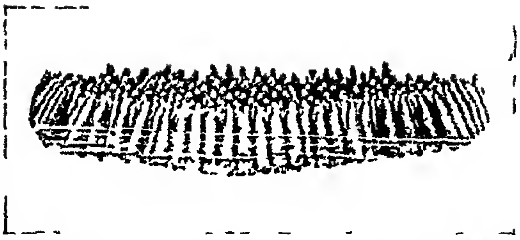
HOW THE MOSQUITOES SPREAD MALARIA



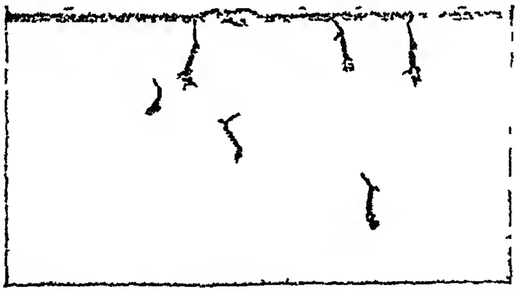
The picture shows a much enlarged section of human skin At the top is a hole caused by an *Anopheles* mosquito's bite, leading into the blood stream In it are malaria spores, with one of them entering a red corpuscle The next three corpuscles to the left show the spores developing Below these are corpuscles illustrating the two phases in the life of the parasites Some spores divide and form round bodies which attack other blood corpuscles creating the symptoms of the disease as shown along the dotted line Others develop into crescent-shaped bodies which are taken up by the bite of another mosquito Below we see the changes which the malaria germ undergoes in the second mosquito's body, finally developing the spores which will infect another human victim.

have difficulty in distinguishing them without a magnifying glass, unless you were an expert But there are ways of telling which is which, even when both specimens are not there at the same time for comparison, and it is worth while being able to, so that you may know whether the little insect that has just stung you is a dangerous one or not

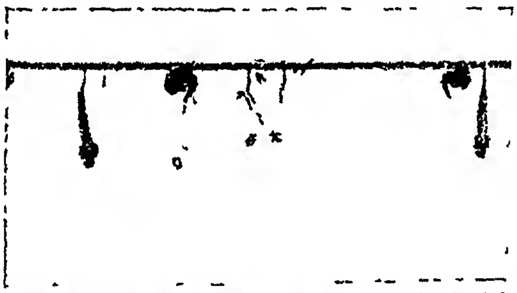
The gnat (*Culex*) when at rest holds its body parallel with the surface to which it is clinging, while the mosquito has it rather cocked up, with the tail in the air The gnat's antennae are longer than the proboscis, or snout, while those of the mosquito are shorter In the latter insect, too, the proboscis looks thick, owing to the length of the palps (sense-organs) which are folded along with it; in the gnat, the palps are short and not usually visible at all In the larval and pupal stages there are other differences, but these are only to be noted when you examine these little creatures with a high-powered lens In both cases, the female is the one responsible for the "bites", the male is harmless, being a drinker of vegetable juices only



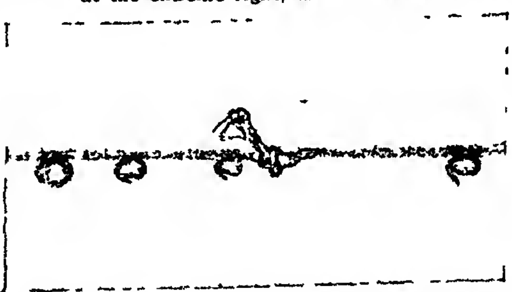
This raftlike mass is a cluster of the gnat's eggs, greatly enlarged, floating upon the surface of a pond, and ready to produce the tiny larvae seen below



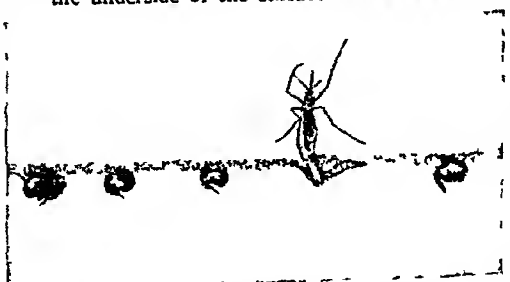
Here are several newly hatched larvae diving into the water They are little water animals, feeding upon minute organisms of various sorts, but they must come to the surface to breathe



Here are several larvae becoming pupae At the left is a larva Next comes a pupa, with the empty larval skin attached, then two empty skins, a pupa, and, at the extreme right, another larva



This view shows a newly-formed adult gnat, crawling out of its pupal skin, which floats like a little boat on the underside of the surface of the water



Before starting on its bloodthirsty hunting life, the gnat is stretching its legs, drying its wings, and gathering strength for its first flight to land

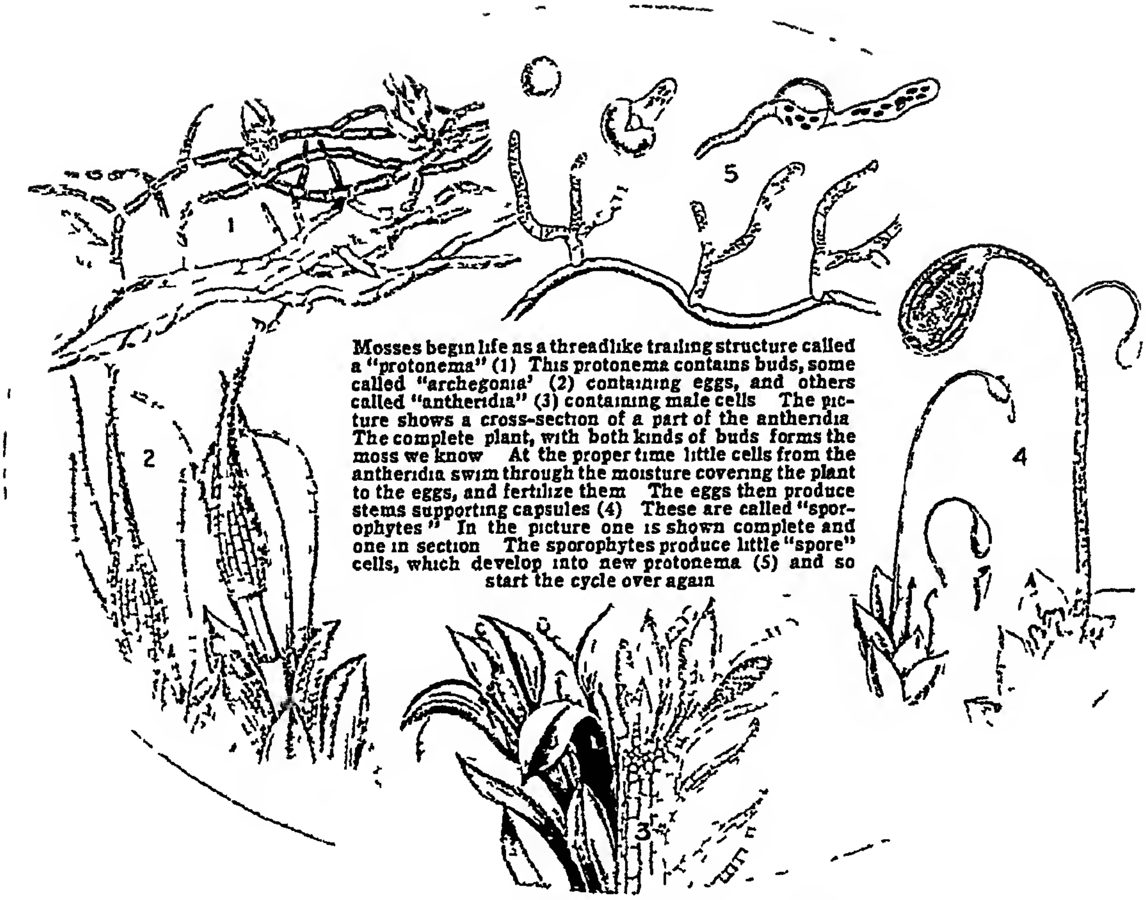
THE LIFE-STORY OF A GNAT

Moss. The mosses which form beautiful green carpet-like expanses on the forest floor, or appear like brilliant green rosettes on decaying logs, wet boulders, and dripping cliffs in ravines and gorges, are masses of very small plants, each of which by itself has a separate stem, and little delicately-formed leaves growing out from it all the way from base to tip

Each moss plant is held firmly fixed in the soil, and obtains its nourishment, by means of a number of little thread-like roots, as is the case with the higher plants Some mosses, instead of standing erect, trail over the ground like tiny velvety vines, which interlace and form a thick dense mat Mosses as a rule delight in moisture, and their habit of growing compactly together makes them able to hold large quantities of water in storage for use during dry periods

Mosses are called by botanists "flowerless" plants, because they do not have the showy blossoms which we are accustomed to see on many of the higher plants The process by which they reproduce is very curious Each moss plant grows up from a tiny green thread-like trailing structure, known as the *protonema*; this sends up, here and there little buds which develop into the moss growths with which we are familiar In the tips of some of these moss plants grow structures called *archegonia*, in which eggs develop In other moss plants grow still other structures, called *antheridia*, in which are developed free-swimming male cells (sperms)

When the moss plants become covered with a film of water, the little sperms go swimming, by means of tiny hair-like appendages (called *cilia*), over to the archegonia and there fertilize the eggs From the egg there then grows another sort of plant, which, curiously enough, takes root right in the top of the archegonial plant where the egg was developed This plant is known as the *sporophyte* (spore-plant)



THE CURIOUS LIFE CYCLE OF MOSS

On top of this sporophyte grows a little case which contains spores Spores are more or less equivalent to the seeds of higher plants, but they are very minute, so that a mass of them together resembles a little cloud of dust When the sporophyte is ripe, the little case at its tip opens, and the spores are scattered about by the wind From each spore there grows a new protonema, completing the cycle

Mosses (*Musci*) are often confused with the liverworts (*Hepaticae*), which, with them, form the group *Bryophyta* in the plant kingdom, and which usually prefer even damper situations, and are green or yellow in colour Most of them may be distinguished from the mosses by their thicker leaves, which look rather soft and fleshy, and usually lie flat on the ground

"Irish moss" is not a moss, but a seaweed, and "Iceland moss" is a lichen (*See* Lichens) "Florida" or "Spanish moss" is a flowering plant Some 5,000 species of true mosses are known, distributed all over the world, and of these the sphagnum or bog mosses are of considerable value to Man Their pale sponge-

LOVELY DETAILS OF THE LOWLY MOSSES BENEATH OUR FEET

If you look at moss under a magnifying glass you will see that it is far more than a carpet of green woolly stuff Sometimes it has a beautiful flower-like growth, as shown by Mnium hornum to the left Or perhaps you may discover a curious "fruit," such as that on Bryum capillaris (centre) Still other mosses look like a tangled forest, such as Hypnum tamariscum on the right

like leaves, filled with hollow cells, absorb liquids with great rapidity, and hence make an ideal surgical dressing with which to pack wounds Large quantities were used for this purpose in the World War of 1914–18

The sphagnums grow in large patches in damp meadows, bogs, and swamps When they occur along the shores of a lake or pond, they often gradually fill up the whole area with their spongy growth Such a filled-up pond is called a quaking bog, because, like some enormous sponge, it trembles and quakes when one walks upon it, while the oozing of the water is heard on every side Some such bogs are as dangerous as quicksands, and have been known to drown men, horses, and cattle Growths of sphag-*num accumulating through thousands of years* helped to form the deposits of peat found in England, Ireland, and other countries

The Earth's First Carpet

At the present time mosses seem rather humble members of the plant kingdom But they played a great part in making the land fit for animal habitation After the most primitive plants (algae and fungi) had carpeted the bare rocks, and by heaping up their dead bodies provided a little store of nutritive soil, the mosses and liverworts appeared and took up the work In time their remains provided a rich soil, and thus made possible the growth of higher plants The mosses and the higher plants together formed the material which supported animal life on land Mosses still exercise this regenerative function when great catastrophes, such as the eruption in 1883 of the Krakatoa volcano off Java, strip the land bare of life

Mother Goose. Who was Mother Goose? Nobody knows, yet everyone of us is acquainted with her rhymes A widely-circulated story declares that the original Mother Goose was a certain Elizabeth Goose (or Vergoose) a widow of Boston, U S A It is claimed that she sang these ditties to her infant grandson, and that the lad's father, who was a printer, published them in a book in 1719 No trace of such a book, however, has ever been found, and long before that date the name "Mother Goose" was used in France in connexion with various stories and myths of a folk-lore character

The first mention of this French "Mother Goose" is to be found in an old French poem of the year 1650 In 1679 a Frenchman, Charles Perrault, published a book of fairy stories under the title "Tales of Past Times, by Mother Goose" It contained such stories as "The Master Cat" (our "Puss in Boots"), "Little Thumb" (our "Hop o' My Thumb"), "Sleeping Beauty," and "Bluebeard" This book proved very popular and was soon translated into English

In 1760 a London publisher named John Newbery transferred the popular name "Mother Goose" from the fairy stories to a collection of old nursery jingles, and the rhymes have ever since borne the name of this mythical authoress (*See* Nursery Rhymes)

A MACHINE *that* CHANGED *the* WORLD

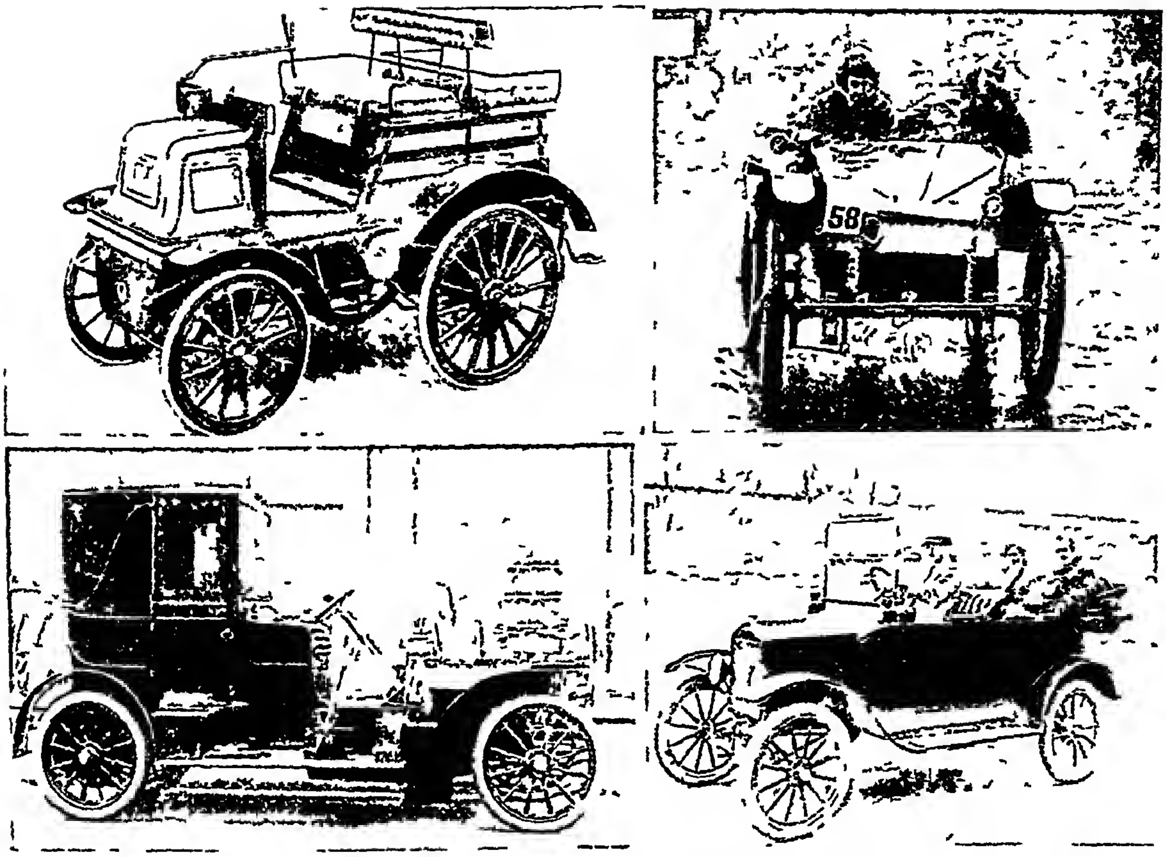
What would our modern world be like without the motor-car? Yet only so recently as 1896 all mechanically-propelled road vehicles had to have a man walking in front waving a red flag!

Motor-car AND MOTORING No invention has more rapidly revolutionized human life than the motor-car In 1896, the year of the first great London-Brighton run, there were only a handful of British-built cars They were clumsy and unreliable, and a horse could easily outdistance any of them Today nearly half a million motor vehicles are manufactured *in one year* in Great Britain alone About 85 per cent are passenger cars, the rest are commercial vehicles of many types, adapted to every sort of transport requirement

Today there are more than 2,000,000 registered motor vehicles in Britain—23 per square mile! Of all motor vehicles in the world, the United States has 80 per cent, and the motor industry of that country has reached gigantic proportions A few years ago a hundred-mile trip was a matter of difficulty, today it is a casual occurrence An endless stream of cars, taxis, lorries, and buses passes daily through every big city Coach routes cover a great and ever-increasing mileage There are even sleeper-buses in which long-distance travellers sleep as they ride through the night

The motor-car has linked the farmer with the town, putting most of the town's advantages within his reach by a few minutes of riding over good roads Motor transport has also revolutionized warfare, through the invention of "tanks" and "tractors," and by making possible the rapid movement of troops

Almost all passenger motor-cars are run by petrol engines, but electric vans are *still* preferred in some delivery systems which require frequent stops and starts, or quiet operation



SOME ANCESTORS OF THE MOTOR-CAR OF TODAY
Top left is a "horseless carriage" of a make still famous in the motoring world—the Daimler. This strange-looking contraption of 1896 had a dog-cart body and tiller steering. Top right is a 1903 Lanchester that was still running in 1932. Below are two more famous types of car. The Napier of 1905-6 (left) was one of the de luxe models of its time, while the Model T Ford, or "Tin Lizzie" (right), was perhaps the most familiar vehicle on the road in the early post-War years.
Photos top right The Autocar, bottom Topical

Now the Diesel engine is making considerable headway in the lorry and passenger car field (*See* Internal Combustion Engine). The first cars had a speed of only a few miles an hour, but cars now speed at 70 to 100 m p h. Special record-breaking cars have exceeded 300 m p h.

The idea of a self-propelled vehicle is not new. Sir Isaac Newton thought of it more than 200 years ago. In 1769 Nicholas Joseph Cugnot, a Frenchman, built what some call the first motor-car. This was a three-wheeled steam carriage which ran a few miles, and then upset because it was too heavy to take a sharp turn at three miles an hour!

Robert Trevithick's steam carriage of 1802—which had driving wheels ten feet in diameter—was another definite landmark in the history of the motor-car. Twenty years then elapsed before the steam road vehicle was really established as a practical means of transport.

It is difficult to decide who built the first petrol-propelled motor-car. Perhaps chief credit belongs to Gottlieb Daimler, a German, who by 1883 had developed a car with a Daimler engine working on the Otto cycle; his first petrol driven motor-car was built in 1887. In the same year two Frenchmen, Panhard and Levassor, patented a clutch and gearbox which were basically the same as those still fitted to the vast majority of modern cars.

In England, the horse transport operators were mainly responsible for the passing of a series of Acts that effectively retarded progress. Two may be mentioned—the famous "red flag Act," which demanded that every car should be preceded by a man carrying a red flag, and the Act restricting speed to *four* miles an hour.

The first great name among the English pioneers is F W Lanchester, who produced his first car in 1895. This incorporated wire wheels, pneumatic tires, and other "modern" ideas.

The historic London-Brighton run in November, 1896, was the occasion for the tearing up amid rejoicing of the red flag, for the Locomotives on Highways Act had just been passed. Henceforth development was bewilderingly rapid. Among the other successful designers in the first decade of the 20th century was F H (later Sir Henry) Royce, soon to become famous as the builder of one of the world's marvels of engineering. It is a noteworthy fact that all the biggest manufacturers in Britain today were building cars before the World War.

It was hard to interest industrialists in the manufacture of motor-cars in the early days. One young American inventor made a car he

believed could be sold at a popular price This was the foundation of the world's largest motor-car factory, the plant of Henry Ford, which has made reliable cars available to millions of people in all parts of the world (*See* Ford, Henry)

This same Henry Ford taught the infant motor industry the principles that placed it in the first rank among industries Those principles were standardization and mass production In the early days cars were often idle because the breaking of some small nut, bolt, or other not very important part meant putting up the car until a machinist could fashion a new part to replace the broken one Ford standardized the parts of his car, and the other makers soon followed him Today the leading manufacturers turn out identical parts in hundreds of thousands A breakdown, therefore, means merely that a new part must be substituted for the one that fails, and these are usually available even at country garages Mass production methods form the basis of the huge factories established by William Morris (now Lord Nuffield), Lord Austin, and others

The modern motor-car factory is a whirring hive of complicated machinery which makes thousands of parts, of many different materials, and performs nearly all the operations of assembling and finishing Every piece must be accurate, some to one ten-thousandth of an inch Every detail of construction has a separate department, such as machine shops, wood working department, paint rooms, and upholstering rooms The complicated engines are put together in still another department Every large factory has its well-equipped laboratory, where scientific research goes on continually in quest of new possibilities in carburetters, engines, rubber, fuel, paint, or anything that would improve the product or reduce its cost Non-splinter glass, to reduce danger of injury in crashes, and stainless steels, made of various steel alloys that do not rust or tarnish, have been developed

Mass production of cars is accomplished by "progressive assembly," which is one of the marvels of modern manufacturing efficiency

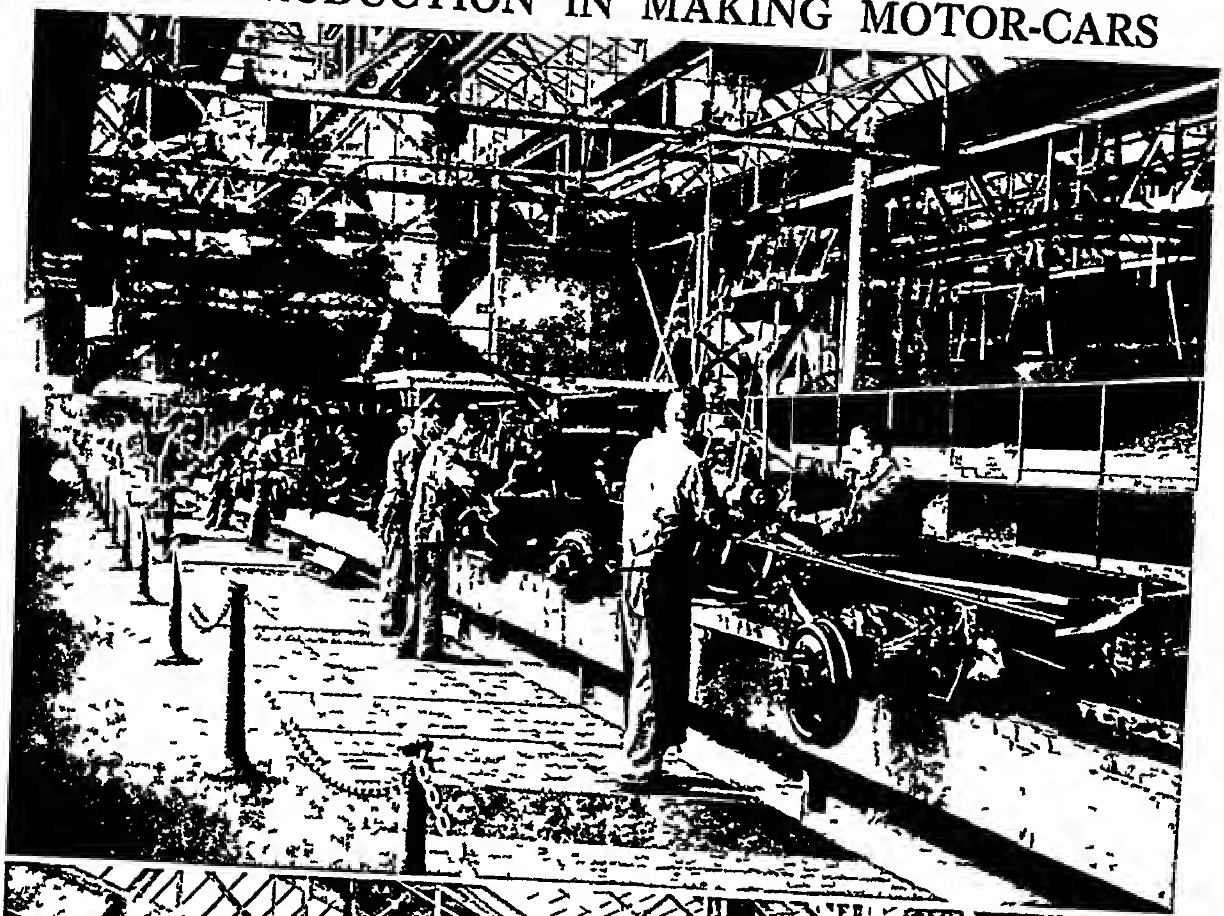
In a typical plant the steps of construction are as follows First, the two long side members are fastened together by the cross members, and this bare frame is placed on a moving platform which is drawn steadily forward along a chain or belt As it moves along its route, workmen attach the various parts —springs, brackets for the running boards, silencer, axles, and many other things A spray of naphtha

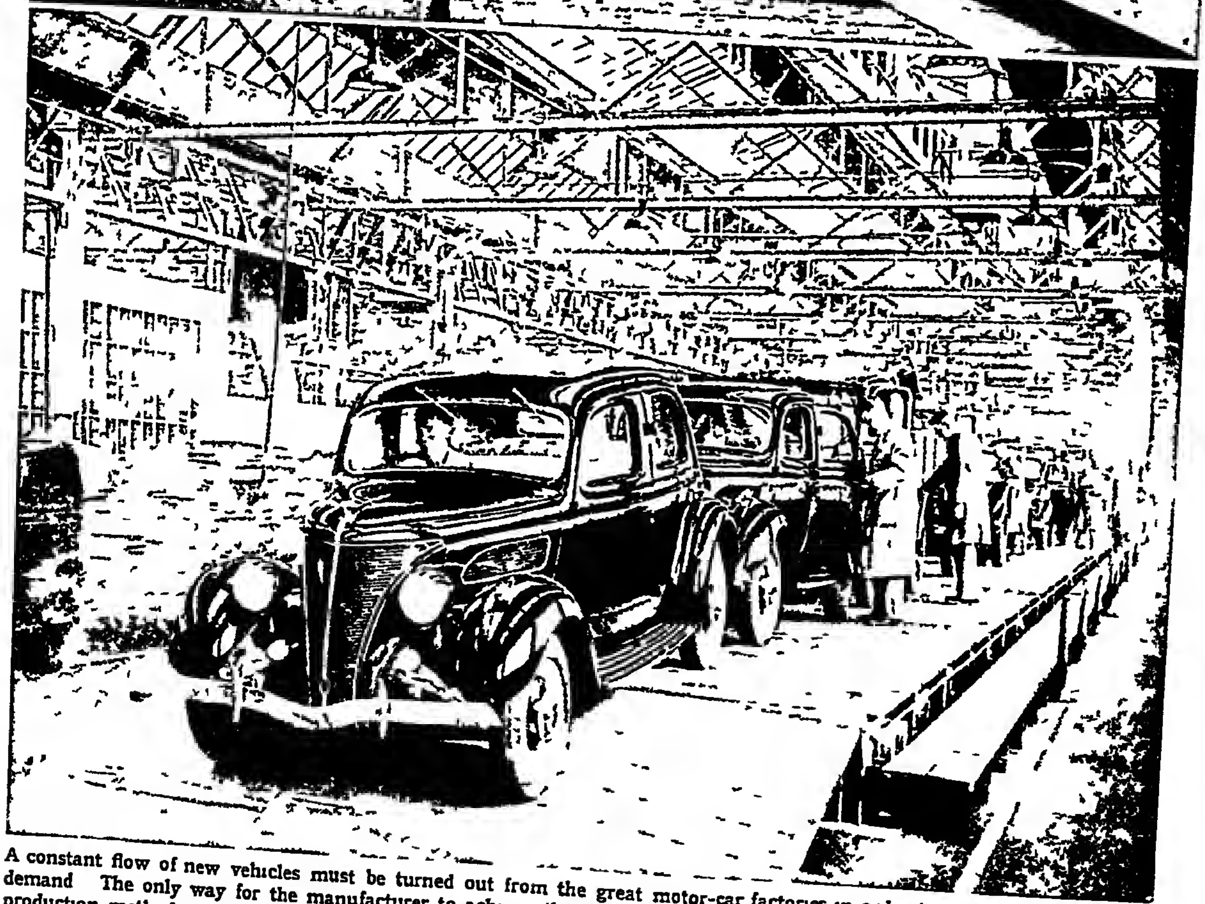
Keystone

DOWN TO THE SEA BY MOTOR-COACH

The "charabanc" has developed into the long-distance motor-coach, and this busy scene in the Victoria Coach Station, London, resembles that on the platforms in the adjoining railway terminus There is now a network of regular coach services to all parts of the country, many travellers preferring the road journey to that by railway

MASS-PRODUCTION IN MAKING MOTOR-CARS





A constant flow of new vehicles must be turned out from the great motor-car factories in order to meet the ever-growing demand The only way for the manufacturer to achieve the necessary combination of quality and quantity is by mass-production methods with a large number of cars under construction at the same time In this page, for instance, we see both ends of one of the assembly lines in the Ford works at Dagenham. The upper photograph shows the beginning of the line, with the chassis in the early stages , below, the finished products are being driven off the line

cleans the frame of any dirt or grease it may have accumulated, and it is then spray-painted in less then a minute The frame is next passed through a drying room built over the assembly line When it reappears on the other side, it gets a coat of varnish and is sent again into a hot room to dry When cooled, it resumes its journey along the assembly line

Now the wheels are slipped on to the axles, the engine comes along another track, is swung down from above, and is fastened securely in its proper place in the frame Next, the electrical system units and other accessories are fitted to the moving and growing assembly Presently the radiator, bumpers, fairings, and running-boards are all in place, and the job is complete except the body When the unit reaches this stage it is called a chassis Finally, the body, with the instrument panel, swings down from above and is fastened to the frame The necessary connexions are made to the instruments—and instead of the bare frame of a short time ago, there is a complete car

Some manufacturers have established large proving grounds at their plants to test each completed machine under actual road conditions Other companies make an exhaustive road test or try out new features of design in an actual race

The motor-car started out as a machine having but one or two cylinders, which gave jerky, uncertain power to the wheels Today it has a power plant of four, six, eight, twelve, or even sixteen cylinders The four-cylinder engine came to be the first standard power plant and continued so for some years To some extent it has given way to the six, and the eight is also popular—particularly in the cheap, fast, and large vehicles of American design

Open bodies were the rule on early cars because closed cars cost much more Since mass production has brought down the price of closed models, the open car is now confined mostly to so-called "sports" models The first touring cars—large, heavy models seating five or more passengers, including the driver—had no tops Now this type, of which few are sold in England, has a leather or fabric hood which can be folded back, and side curtains There are still a number of open two-seaters with a "dickey" seat behind Sports models are usually lower-built than regular types of the same make, being designed for higher speeds

Some Types of Motor-Cars

The coupé, the smallest closed car, usually has a rigid top and glass windows, with one seat for two persons The "drop-head" coupé is an attractive variation

The saloon, by far the most popular type of bodywork, has only one compartment There is often a sliding "sunshine" roof

A limousine is a completely closed car, with windows separating chauffeur from passenger compartment, which may have one fixed seat for three persons and two folding seats The cabriolet has a hood extending over both passengers and chauffeur, from whom the passengers usually are separated by a glass shield A landaulette has a folding hood over the rear compartment, the front covering is fixed

Many special bodies are built by coach makers, particularly for the more expensive cars Caravans and trailers, containing sleeping quarters, kitchenettes, and other conveniences, are not uncommon

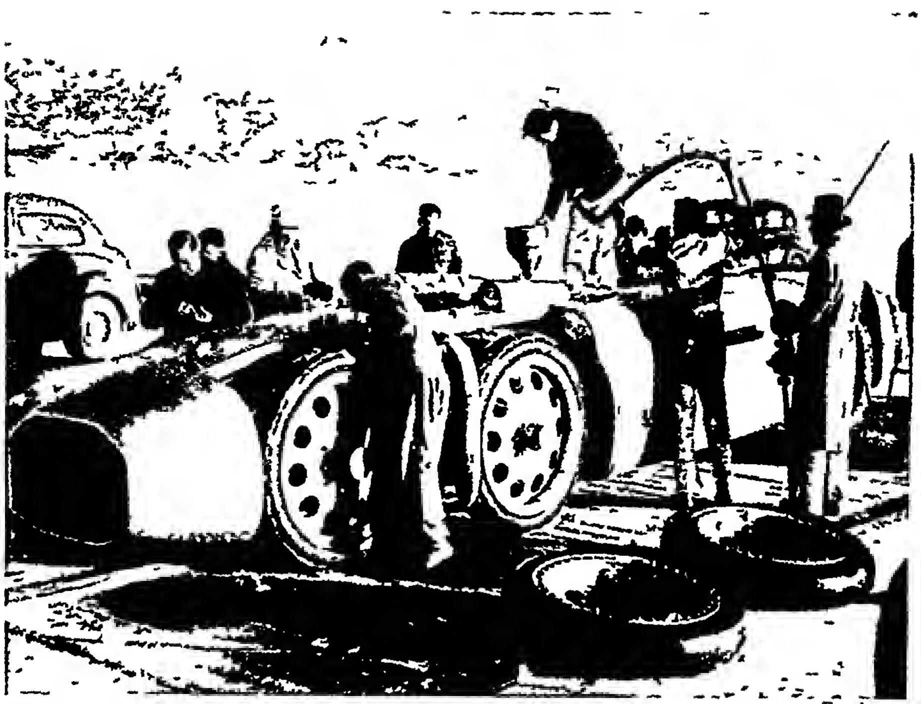
For some years following the World War designs remained much the same Then some designers tried the front-wheel drive, with engine, transmission, and front axle all in one unit Special universal joints made it possible to steer with the front wheels while they were under power

The depression of 1929–32 forced many changes in an effort to win sales Lighter

COMPETITORS IN A FAMOUS ROAD RACE

The Grand Prix d'Endurance held every year at Le Mans in France is the world's most important road race The cars are not specially built racers, but are such as anyone can buy and drive on the roads Yet these two British competitors, though they are rounding a bend, are travelling at a speed of a hundred miles an hour or so

Courtesy of "The Autocar"



Keystone

REFUELLING THE 1937 RECORD BREAKING 'THUNDERBOLT'

The world s land speed record, held for many years by Sir Malcolm Campbell, fell to another famous English racing driver, Capt G E T Eyston, on Nov 19, 1937, when he covered the "flying mile" on Salt Lake Flats, Utah, U S A., at the astonishing speed of 311 42 m p h In August, 1938, Eyston improved this speed to 345 m p h, and again in September 16 he set up a new record of 357 5 m p h

engines with higher compression ratios came in, to give more power at less cost, gears were silenced, and transmissions and clutches improved, controlled ventilation gave fresh air without draught in closed cars Riding comfort was improved by suspending the front wheels from separate springs instead of on one axle A still more striking change was the trend toward streamline or semi-streamline, design, reducing air resistance and improving the car's looks Fittings like spare wheel and luggage carrier are now totally enclosed

A side of motoring that indirectly improves the lot of every motorist is racing Motor racing is now a highly organized sport which attracts huge crowds eager to watch their favourite "aces" hurtling at breakneck speeds round a special track or over roads No great road races are held on a public highway in England, because English law does not permit it The nearest approach is the R A C Tourist Trophy (T T) race for sports cars, previously held on the Ards circuit in Ulster, but transferred in 1937 to the new circuit at Donington Park, Derbyshire Another great race held at Donington is the Grand Prix, at which the fastest Continental racing cars are seen

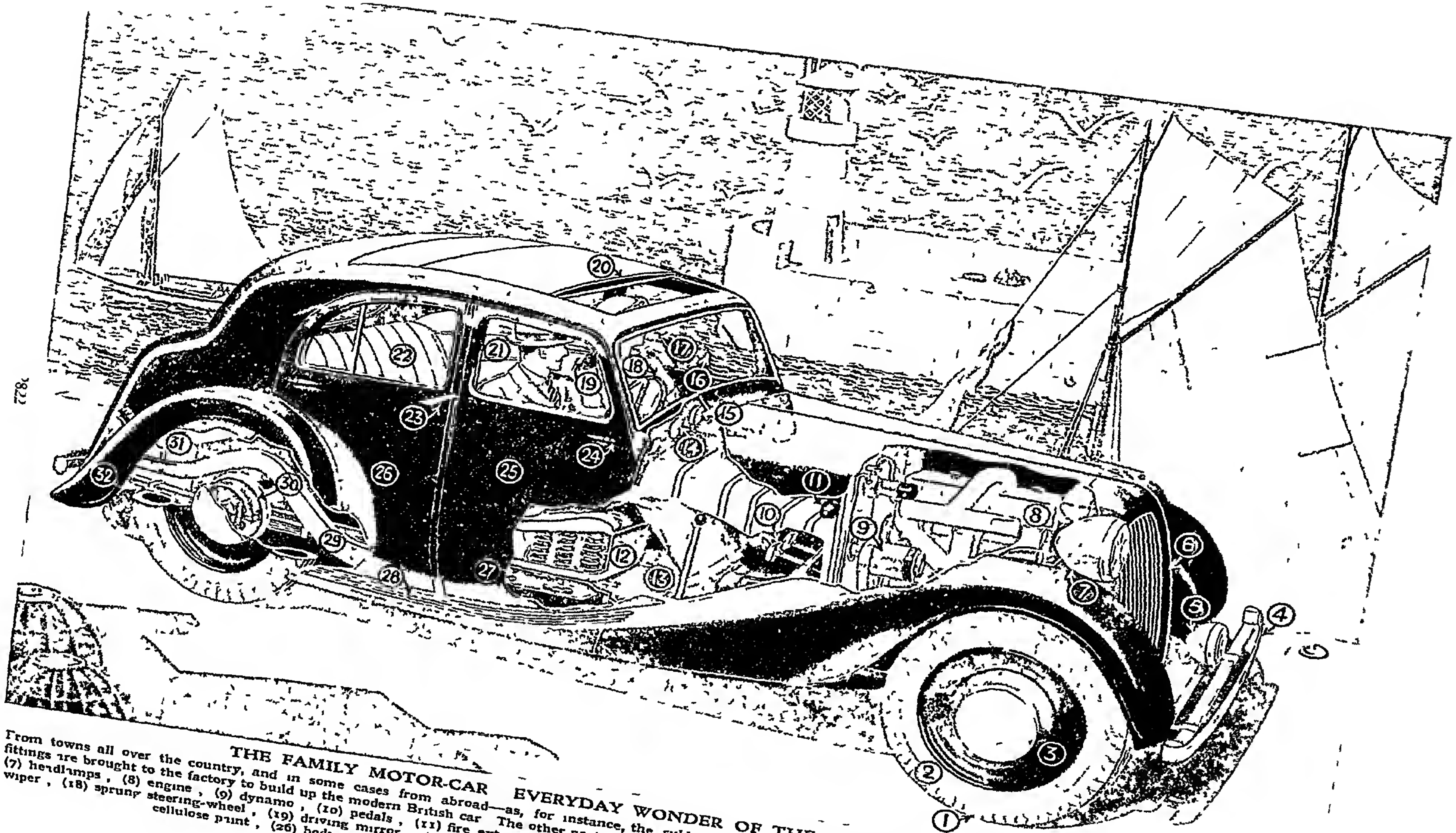
Famous Races for Sports Cars

The most famous of foreign sports car events is the Le Mans 24-hour race, in which the Grand Prix for distance covered is the most coveted award The French Grand Prix race is now also for sports cars only Ordinary village streets have to be negotiated in events like the Monaco Grand Prix and the R A C "round-the-houses" races in the Isle of Man

The great English racing track is, of course, Brooklands, near Weybridge, in Surrey This was originally built in 1907, but has been frequently relaid It is of pear-shaped design, a lap measuring about 2¾ miles There are now three circuits at Brooklands, including a road circuit opened in 1937 Notable races are held here annually, such as the British Racing Drivers' Club's "500" Then there are meetings, consisting of several races, on days like Whit Monday Foreign "speedways" include Montlhery near Paris, the Avus track (Berlin), the Nurburg Ring in S W Germany, and America's great track at Indianapolis

The English sporting motorist finds many other events to engage his attention There are strenuous hill-climbing competitions, notably that at Shelsley Walsh (Worcestershire), reliability trials, and long-distance rallies The most famous of the latter is the Monte Carlo Rally, to which cars are driven from places in the most remote parts of Europe In connexion with this severe test of car and driver, there is a *Concours d'Élegance*, prizes being awarded for the smartest and best-equipped cars

The fastest cars on earth—those designed simply and solely to capture the world's land speed records—cannot, of course, be "let loose" on an ordinary racing track Drivers like the late Parry Thomas, the late Sir Henry Segrave, Sir Malcolm Campbell, Cobb, and Capt Eyston had to find an absolutely level and obstruction-free surface stretching for miles for their record attempts Pendine Sands in Glamorgan were tried, but eventually found wanting, then Daytona Beach in Florida became popular, but nowadays the Salt Lake Flats, Utah (also in U S A) is the principal scene for some of the most astonishing feats ever performed by Man or machine (*See also* in Fact-Index under Records)



THE FAMILY MOTOR-CAR   EVERYDAY WONDER OF THE TWENTIETH CENTURY

From towns all over the country, and in some cases from abroad—as, for instance, the rubber (1) for the tires, which probably comes from Malaya—materials or completed fittings are brought to the factory to build up the modern British car The other parts marked are (2) the tires themselves, (3) disk wheels, (4) bumpers, (5) fog lamp, (6) radiator, (7) headlamps, (8) engine, (9) dynamo, (10) pedals, (11) fire extinguisher, (12) seat springs, (13) mats, (14) clock, (15) speedometer, (16) safety glass, (17) windscreen-wiper, (18) sprung steering-wheel, (19) driving mirror, (20) sliding roof, (21) wood panelling, (22) rep upholstery, (23) traffic indicators, (24) chromium fittings, (25) cellulose paint, (26) bodywork (27) batteries (28) running-board (29) chassis, (30) brake linings (31) petrol tank, (32) springs

The rule of the road in force in the United Kingdom demands that all vehicles approaching one another shall keep to the left of the road This is the opposite to the "keep right" rule obtaining in almost every other country in the world British cars are, therefore, built with right hand steering On all roads drivers are supposed to keep close to the near (left) side, leaving the centre clear for cars wishing to overtake them Where one driver seeks to pass another from the rear, he should signal his intention and pass to the other driver's right The driver ahead must keep to the left, giving ample room to pass, and must not increase his own speed A driver must not attempt to pass another on a bend or a hill-top Before trying to pass a car ahead, he must be sure he has sufficient clearance to get safely back into line, without having to cut in between cars It has always been assumed that a vehicle reaching an intersection of two roads first has the right of way, but main road traffic takes precedence over that from side roads Pedestrians along a road are supposed to face vehicular traffic—that is, walk on the right All these and many other examples of good conduct on the roads are contained in the Highway Code booklet

The Law Affecting Motorists

Motor law in Britain is governed by the Road Traffic Acts, 1930 and 1934 The most far-reaching change in the latest legislation is the establishment throughout the country in all built-up areas of a uniform speed limit of 30 m p h Local authorities have power to enforce certain restrictions on parking, etc

There are also laws about lights for cars, since many accidents are caused by glaring or improperly adjusted headlights Every car must turn on at least its side and tail lights after lighting up time No hooting is allowed in a built up area between 11 30 p m and 7 a m

All who have anything to do with motor-cars—and that means nearly everybody—should have a clear understanding of the principles of their working This may save many an awkward moment, perhaps standing by helpless when a car breaks down on a country road But to know the theory of a motor-car does not necessarily mean a knowledge of driving one One learns to drive a motor-car properly only by careful practice under a variety of conditions By the experienced driver the right thing is done instinctively, and driving becomes a pleasure both to the driver and those with him The best maxim is "Never put yourself in a position where you have to depend on the other man to save you from a smash" (*See* Road Safety)

Licences and Tests for Drivers

Every prospective motor-car driver must be at least 17 years of age, and official driving tests must now be passed The licence is obtained from the local County Council and periodically renewed In addition, a tax is imposed on every motor vehicle, and the latter must be covered by an insurance policy for "third party" risks The greater part of the taxes is paid into the Road Fund New drivers who have not yet passed their test must hold a provisional licence, carry "L" (for learner) plates on the car, and always be accompanied by a licensed driver

How much does it cost to run a car? Today it is estimated that the average cost for an 8 h p car is 2 18 pence a mile, on an annual mileage of 5,000 These same figures put the average yearly cost of a car at just over £45 (not including garage) A car depreciates in value at least 20 per cent in its first year

How the Modern Motor-Car Works

THE modern motor car is a marvel of compact arrangement Everything that clever engineers can do to make it dependable and easy to run has been done While its mechanism may seem at first extraordinarily complicated, once you have learned the purpose of each of the parts, you will realize how essentially simple is the general plan

Let us now, with the help of the pictures, master the details of this wonderful machine and see what happens when the driver begins to work the controls

THE MOTOR CAR'S "BRAIN CENTRE"—The man who drives a car must think of nothing else He has enough to do His hands and feet are instantly ready and alert, and his whole attention must be divided between the road and the controls used in operating the car He has before him (Fig 1 in the following page) the steering wheel, the gear lever, the brake pedal with the clutch pedal at its left, the parking or hand brake lever, the starter button, the accelerator pedal for controlling the intake of gas and thus the speed, and the horn button in the centre of the wheel

The brake pedal operates the "service" brakes, used in ordinary driving These brake all four wheels by means of metal shoes lined with friction material which engage with the surfaces of the brake drums The hand brake may operate on either the rear brake drums or on a drum on the propeller shaft of the transmission system

The gear lever is moved into any one of four, or sometimes five, positions to select the proper gear ratio for the varying conditions met in driving If it is in "neutral" position the engine is disconnected from the drive shaft When in this position the engine may be left running and the car will not move, even if the clutch is left in The clutch is used to transfer the power of the engine gradually to the transmission and thence to the drive shaft It should be let in gradually to avoid jerking or damaging gears or other delicate parts of the car's mechanism

There are a number of other controls and devices to watch On the dashboard is the instrument panel On the make of car shown here the "dash" contains a "choke," clock, ignition key and light switch, hand throttle, speedometer, oil pressure gauge, ignition warning light, and petrol gauge The choke enriches the mixture of petrol and air to start a cold engine, the light switch controls all the lights the speedometer, driven by a flexible shaft from the transmission, is a

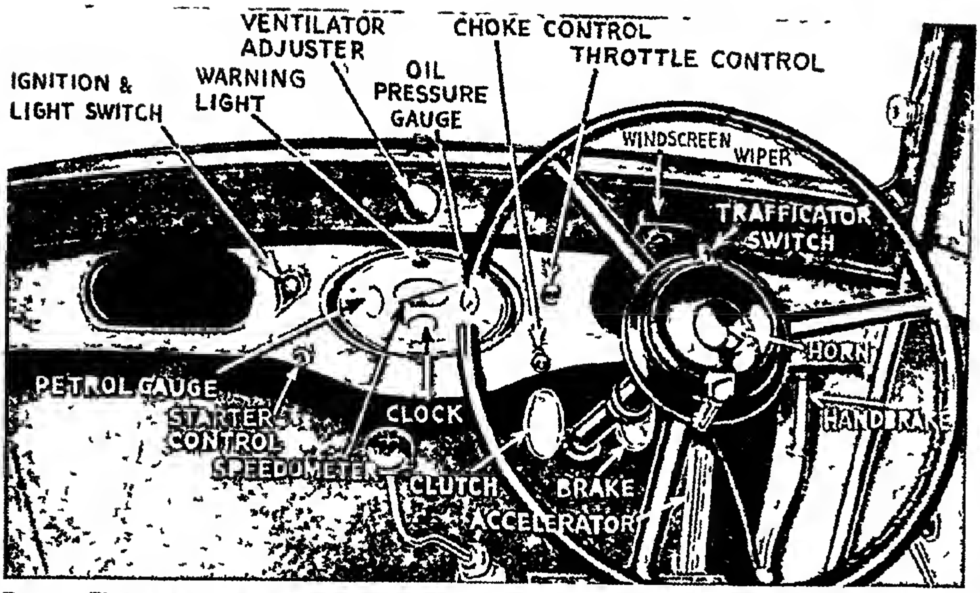


Fig 1 This is a typical arrangement of the controls and instruments board as fitted to a medium-sized car They are grouped in the most convenient position for the driver On either side of the "dash" is a "cubby hole" The gear lever is to the left of the wheel

clock-like device which tells how far the machine has travelled and how fast it is moving, the throttle governs the operation of the engine, and the oil gauge tells if there is enough lubricating oil in the crankcase and if it is circulating properly An ammeter shows if the dynamo is not charging the battery as it should The ignition key helps to prevent theft of the car, often the same key operates the door locks

Near the instrument panel, on the right, is the button which controls the automatic windscreen wiper, and in a suitable position for the driver (often outside the car) is his driving mirror, required by law Conveniently placed on the steering-wheel is the switch for the electric traffic indicators, or "trafficators," now commonly used instead of hand signals

Both the steering wheel and its supporting column are usually made of a steel core covered with hard rubber or some such composition as bakelite

A small electric bulb illuminates the grouped instrument panel by indirect light, keeping the glare from the eyes of the driver The panel is covered with glass to protect it from dust and moisture, and it can be removed as a unit for repairs

Each instrument has a story for the careful driver, and he always heeds what each tells him Failure to do so might mean serious damage to the engine or accessory parts, such as the battery or dynamo

Now that we have examined the controls of the car, let us turn to the "skeleton," or, more properly speaking, the "chassis"

THE CHASSIS AND ITS PARTS—In Fig 2 we look down from above on the chassis of a car with all the essential parts in place At the front is the radiator, which helps to keep the engine cool From the engine itself we can trace the path of the power to the rear wheels through the clutch, transmission, propeller shaft, differential, and rear axle On the right side of the engine, near the front, is the dynamo which charges the storage battery On either side are the starting motor, the ignition distributor, and the pump which supplies petrol to the carburetter The starting motor eliminates the former labour of turning over the engine with a hand crank The distributor sends electric current to the sparking plugs in each cylinder, timing each spark so that the explosions take place in proper order Attached to the frame also are the accumulator or battery and the brackets to support the running board

On the left side of the chassis are the exhaust pipe and the silencer for the exhaust The silencer usually consists of a chamber or series of chambers in which the exhaust gases are allowed to expand slowly through baffle-plates A tail-pipe carries them out at the rear, so that poisonous fumes cannot reach those in the car

The frame of the car is fairly simple, yet it must be well designed, and built of strong pressed steel, to withstand the severe twisting and bending strains to which it is subjected The long, rail-like parts which compose the sides of the chassis are made in "deep section"—that is, deep enough from top to bottom to withstand the stress imposed by the weight of the engine and the body Since steel grows tired, or "fatigues," as the engineers say, every effort is made in car designing to guard against undue bending and twisting of the frame, and the crystallization which repeated bending causes,

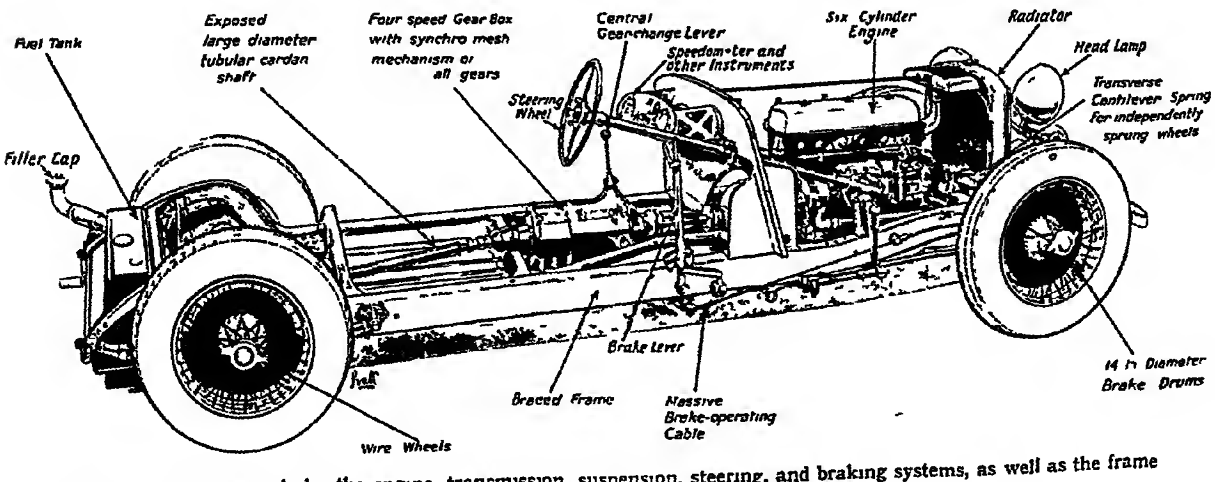


Fig 2 The chassis includes the engine, transmission, suspension, steering, and braking systems, as well as the frame

Courtesy of "The Autocar"

Obviously a flimsily built frame will soon develop annoying rattles and squeaks, both in itself and throughout the whole body bolted to it. Strong cross members are riveted to the side frames, and at the joints, stiffening pieces, called "gussets," help to keep the frame from getting out of line fore and aft. Probably no other industry has contributed so much to the chemistry of steel and the development of its alloys as has the motor trade. Safety is of first importance in a car, but light weight is essential to economy in construction and economy in operation.

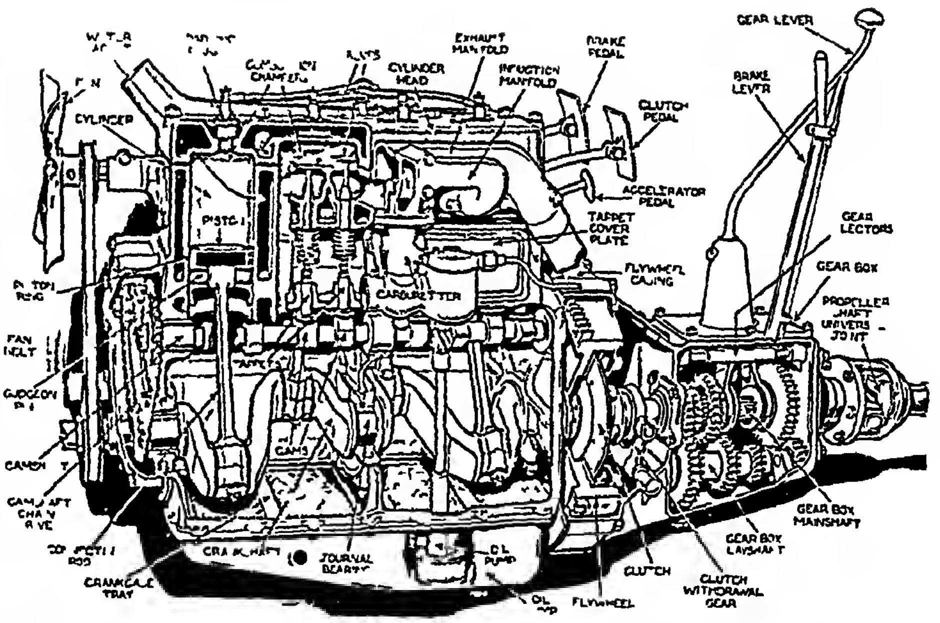


Fig 4 This is a four-cylinder side-valve engine with clutch and gear-box in section. The various parts and components referred to in the article are easily distinguishable. Only the front cylinder is shown completely sectioned

Courtesy of 'The Autocar'

Keeping in mind the general plan shown, let us examine the details of a motor car, one by one.

STEERING MECHANISM.—The general layout of the steering mechanism is shown in Fig 3. The inclined steering column or tube *a*, the upper end of which carries the steering hand-wheel (not shown), operates the steering lever or drop arm *b* through worm gearing or other mechanism completely enclosed in the steering box *c*. The lower end of the lever *b* is connected by the drag link *d* to a lever *e* projecting from the offside steering head, while the offside and nearside steering heads are connected by the track rod *f*, so as to move together. The front and rear ends of the drag link *d* are connected to the levers by ball and socket joints "loaded" with springs so that there is no slack.

The amount of movement that can be given to the front wheels is limited, and the terms wheel lock, steering lock, or, simply, lock, are used in this connexion. The greater the lock the smaller is the turning circle of the car, and the more easily may it be manoeuvred in limited spaces.

THE ENGINE.—Fig 1 shows a four cylinder engine—the centre of power—seen from the left side—a more detailed view of parts shown in Fig 2. Beginning at the left we see the fan, driven by a belt from a pulley on the front end of the crankshaft; then the timing chain from the crankshaft to the camshaft. Next come two cylinders, the first cut away to show the piston and connecting-rod, and the second showing its two side valves, also the water jacket surrounding the cylinder and exhaust and intake ports. The valves are operated in this case by adjustable tappets. The tappets are worked by the cams on the camshaft, which lift them one by one as the camshaft revolves (*see* Timing Gear section). Valve springs return the valves to their seats.

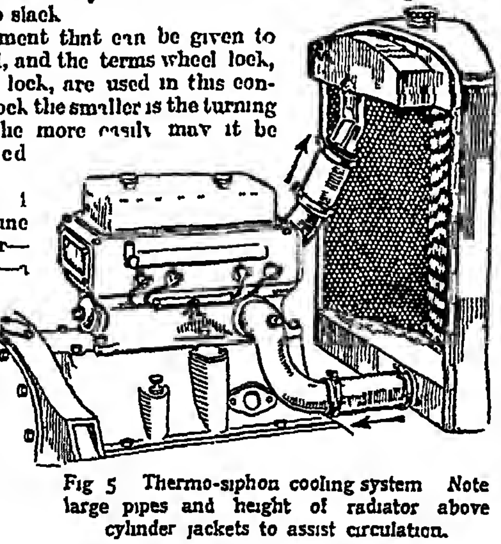


Fig 5 Thermo-siphon cooling system. Note large pipes and height of radiator above cylinder jackets to assist circulation.

Engines of this type are called 'side valve' engines; others have overhead camshaft and valves, the "sleeve valve" is yet another type.

COOLING SYSTEM.—When we think of the constant fire of explosions in the engine, it is easy to see that some cooling arrangement is needed to keep the engine from overheating. Most motor car engines are water cooled. A current of water already cooled in the radiator is pumped into the jackets around the cylinders, flowing back to the radiator through the upper pipe. There it is again cooled by the rush of air drawn through the radiator by the fan. The radiator has a large number of thin-walled tubes or cells through which the water flows. Few types of car are entirely air cooled, but many use a simpler system of water-cooling known as thermo siphon (*see* Fig 5).

In cold weather care must be taken to keep the water from freezing, which would stop its circulation, and might even burst the radiator or the heavy engine casting. Some chemical which has a low freezing-point may be added to the water in winter.

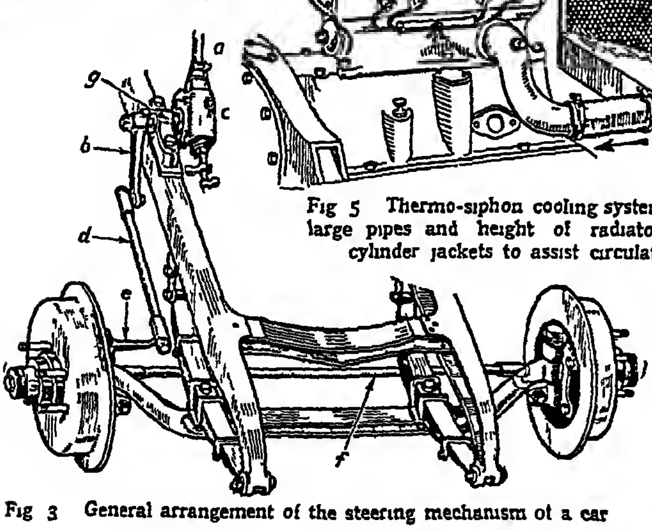


Fig 3 General arrangement of the steering mechanism of a car

THE ENGINE AT WORK.—In the article on Internal Combustion Engine will be found a simplified diagram, showing an engine cylinder and illustrating the cycle of operations necessary to give an explosion. In each car engine cylinder an explosion occurs once in every two revolutions of

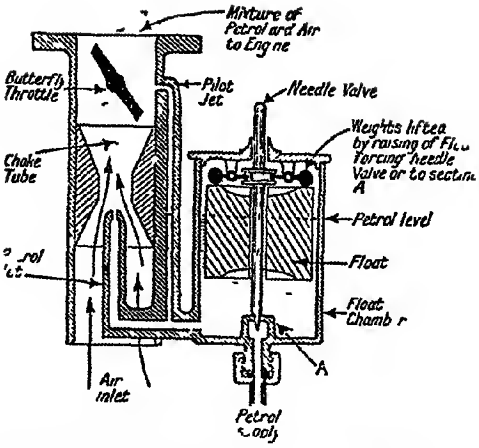


Fig 6 Diagram showing how the air and petrol are mixed and then supplied to the engine proper

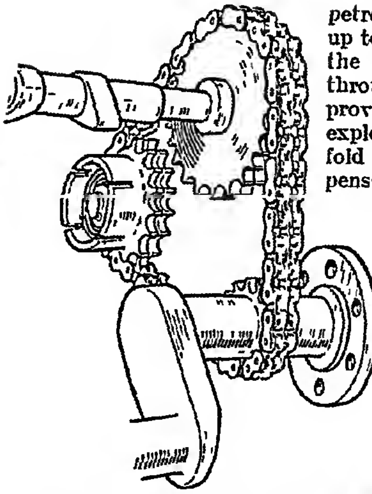


Fig 7 Roller-chain drive connecting crankshaft and camshaft

the crankshaft This means that the piston travels down and up twice during the cycle, which is called the Otto four-stroke cycle in honour of its inventor A mixture of air and petrol is drawn into the cylinder by the suction of the piston in its downward movement This is called the intake stroke The inlet valve closes and the piston compresses the mixture into a very small space on its upward path This is the compression stroke Then the spark is delivered to the cylinder and the charge is exploded, and this expands and forces the piston down again This is the third or firing stroke Next the exhaust valve opens, and the piston again goes up, pushing the burnt gases out into the exhaust manifold from which they pass into the air, thus completing the fourth and last stroke These steps, of course, are repeated in extremely rapid succession

WHAT THE CARBURETTER DOES —The carburetter is a marvellous little device in which petrol and air are mixed This mixture is drawn into the cylinders where it is exploded by the spark just in time to drive the piston down and propel the car Although there are many different types of carburetters, the general principles illustrated in Fig 6 apply to all of them The liquid petrol from the tank is led into the float chamber either by the simple force of gravity, a vacuum tank system, or by an engine-operated pump When the petrol in the float chamber reaches a certain level, the rising of the float automatically closes the needle valve and cuts off the supply The level is so adjusted that the main jet is constantly filled almost to the tip

It is shown in page 2234 that the downward motion of the piston in the cylinder on the left causes a suction through the induction pipe The carburetter is attached to this pipe, and receives this suction, which draws air in through the air inlet shown As this air is forced to go through the narrow funnel-shaped opening round the main jet, it travels with great speed and draws the petrol through the nozzle in the form of a fine vapour or spray which mixes with the air, making the explosive gas that is carried through the upper pipe, or manifold, to the engine cylinder The throttle, which is operated by the hand lever or foot accelerator, regulates the flow of air, and thus determines the amount of petrol that is drawn from the main jet The more petrol in the mixture, the more power up to a certain point In order to keep the engine running slowly when the throttle is closed, a small idling jet is provided, which lets a small volume of explosive mixture into the intake manifold just above the throttle A compensating jet in conjunction with a dash control allows the driver to regulate the flow of petrol so that it gets the best proportion of liquid into the air A choke can be used to close off the air so that the mixture will be rich in petrol for easier starting The proper proportion for the mixture by weight is approximately 15 parts air to one of petrol A stop screw controls the idling speed of the engine

THE TIMING GEAR —To ensure the proper operation of an engine, it is essential that all parts of the engine function "in time," as the engineers say This is regulated by the timing gear such as is shown in Fig 7, comprising a chain and sprockets

The picture shows how the small sprocket fixed to the crankshaft drives the large one on the camshaft The latter gets its name from the cams it carries These are metal projections which revolve with the shaft, and every time one comes round on top, it opens a valve

THE CLUTCH —The clutch is a device for disconnecting the engine from the rest of the driving mechanism The type illustrated (Fig 8) is known as the single plate clutch The parts of this clutch are named in order from the engine (left) to the transmission Other forms are the double plate and multiple disk clutches All are similar in action One or more friction surfaces are permanently connected through the flywheel to the engine, and one or more are connected to the transmission gear system When the clutch is thrown out by pressing down the clutch pedal, only the first of these surfaces revolves with the engine But when the pedal is released the two meet, grip each other and revolve together This passes the power on to the transmission gears The chief purpose of the clutch is to enable the driver to shift the gears while the engine is running, as described and shown in the succeeding sections

In the ingenious "fluid flywheel" or hydraulic coupling system fitted to a few makes of cars, the ordinary clutch is superfluous The effect is such that the flywheel, immersed in oil, functions without any possibility of fierceness in taking up the drive It is normally used in conjunction with a pre selective gear box by which the actual gear change is performed by depressing the clutch pedal after selecting the gear by a lever on the steering-wheel

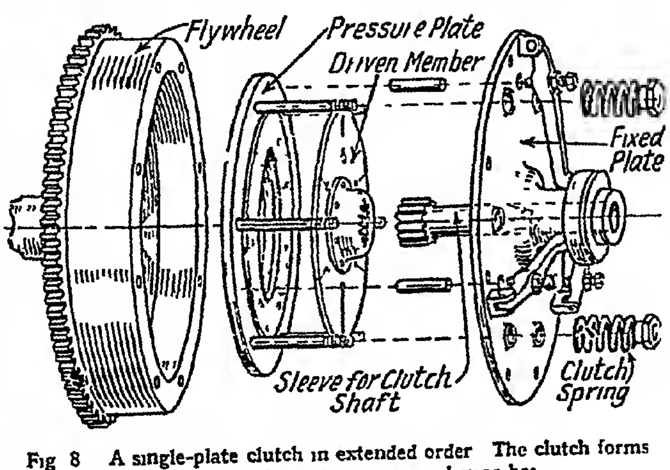


Fig 8 A single-plate clutch in extended order The clutch forms the coupling between engine and gear-box

THE GEAR BOX —Petrol engines have little power at low speeds If the engine were always connected through the clutch directly to the drive shaft, it would be impossible to start it as easily as we do, nor would it be flexible enough for general use To overcome this inherent weakness in the transmission gear system is used The chief principle of this system is that when two gears of different size are meshed or linked

together, the large one will revolve more slowly (and with more force) than the small one. If the large one has twice as many teeth as the small one, it will make only one turn while the small one turns twice. This makes it possible for the engine crankshaft to revolve rapidly, while the propeller shaft revolves slowly.

With the object of making clear the principle of operation of change speed gearing and before turning to a later type of gear-box having constant mesh helical teeth for giving silence of operation, reference should first be made to Fig. 9, in which is illustrated, in diagrammatic form, the three speed and reverse gear of the ordinary sliding pinion type. The driving shaft *a* and the driven shaft *b* of the gear box are connected respectively to the clutch shaft—i.e. the driven member of the clutch, and to the propeller (cardan) shaft.

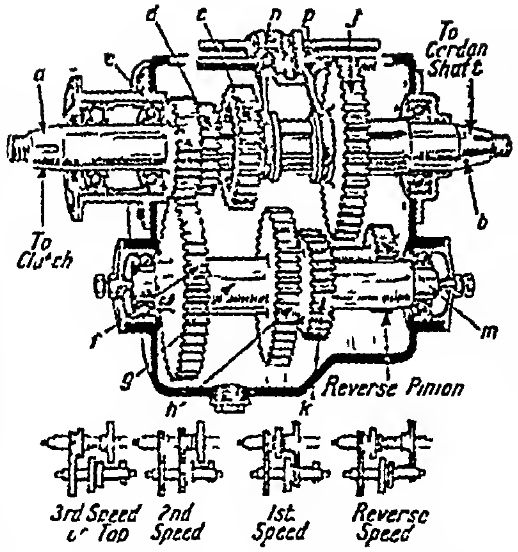


Fig. 9. A three speed gear-box with direct drive on third (top) speed, as explained in the text

In all modern gear-boxes these two shafts are in line, so that when they are clutched together a direct drive is obtained through the gear box, the gear wheels in which then merely rotate idly. In the construction shown the forward end of the shaft *b* is spigoted in the rear end of the shaft *a*, the connexion between these two being either a plain or a ball bearing. The two shafts are clutched together when the gear wheel *c* is moved to the left so that internal teeth on this wheel engage over the teeth *d* at the side of the gear wheel *e*, which is integral with, or fixed to, the shaft *a*. The wheel *e* is permanently in mesh with the wheel *f* mounted on the countershaft *g* which is usually arranged vertically underneath the main shafts *a* and *b*.

To obtain the next lower, or second, speed the gear wheel *c* is moved to the right, out of engagement with the teeth *d*, into the neutral position in which it is seen in the diagram. It is then moved farther to the right until it engages the gear wheel *h*, which rotates with the wheel *f*. The shaft *b* is then driven at a lower speed than the shaft *a* through a gear train *e*, *f*, *h*, *c*. When a still lower gear ratio is necessary, the wheel *c* is moved into the neutral position and the wheel *j* is moved to the left to engage the wheel *k* carried by the countershaft. It will be noticed that the pair of wheels *k*, *j* give a different gear ratio from the pair *h*, *c*; shaft *b* is therefore driven from shaft *a* at a still lower speed.

Every vehicle above a certain weight must be provided with a reverse gear, and in the present case the reverse is obtained by sliding the gear wheel *j* to the right until it engages the reverse pinion *m*, which is mounted on a shaft carrying another gear wheel (not shown) permanently in mesh with the wheel *k* on the countershaft.

The small diagrams show how these changes may be made, wheels not in use in each case being in outline only.

In this, as in all modern gear-boxes, it is possible to select and to engage any one of the gears directly without passing through any other gear. To enable this to be done the gear wheels are operated in what is called a selective manner. The gear lever may be moved to engage a groove in either of the two sliding members *n*, *p*, the member *n* being connected to and operating the gear wheel *c*, while the member *p* operates the gear-wheel *j*. When either wheel is operated the other is necessarily in neutral, so that the gear box cannot be jammed by the simultaneous engagement of two pairs of wheels of different ratio.

The top gear or direct ratio between the engine and the axles is usually between 4 and 5.8, there being considerable variations according to the size of car. This top gear ratio has shown a tendency to become lower of recent years owing to higher engine speeds. To take a typical example of modern gear ratios, if the top gear ratio is, say, 4.5, the second gear would be so selected that the overall gear ratio is about 7.5, that is, the axle would make 7.5 revolutions for every revolution of the engine. The first speed gear would be about 13, and the reverse gear probably rather lower than this, for example, 15. These various gear ratios differ considerably with different makes of car, but the above range may be taken as typical.

Many cars are now fitted with a gear box giving four forward speeds and one reverse speed; this additional speed ratio increases the size, weight, and expense of the gear box substantially, and there is still some difference of opinion as to whether it is necessary. It would seem that, generally speaking, a four-speed gear box is particularly desirable in the case of a car having a small high speed engine, and that it may be superfluous where a large low speed engine is fitted.

A very great number of gear boxes are constructed in which the several pairs of gear wheels are always in mesh, and the different changes are made by connecting the wheels to their shafts, as required, by means of substantial dog clutches. For instance, Fig. 10 shows a gear box which has constant mesh, helically cut gears on both second and third speeds. The gear changes are effected by sliding the dogs shown on the upper, main shaft into engagement.

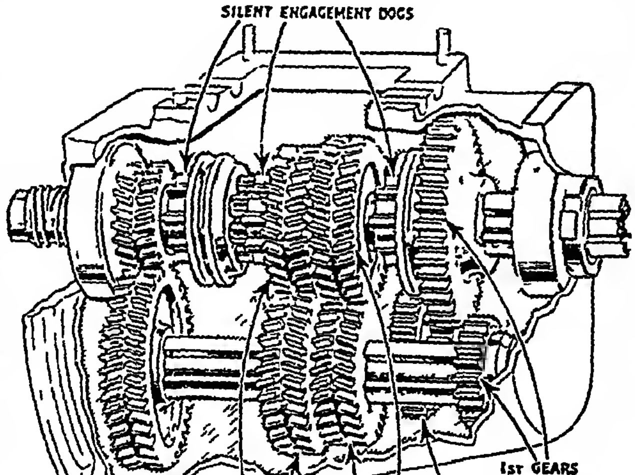


Fig. 10. Gear-box arrangement of a modern 14 h.p. car. It will be seen that helical gears are incorporated for both second and third speeds

The principal difficulty of gear changing lies in the synchronizing of the speeds of the two gear wheels whose teeth have to be meshed. In the synchromesh gear-box a small friction clutch is employed to do the work of synchronization. It is possible to do the ordinary movements of double declutching with the synchro mesh gear-box, and with that system the changing can be invariably smooth and effortless. But double declutching is not

necessary, changes up and down can be made directly without noise provided the gear lever is moved deliberately and the cone clutches are given time to do their work Some cars have an overrunning clutch in the gear assembly, which disconnects the engine when the wheels tend to run faster than the engine does, as in going downhill This is done with rollers in tapered slots, which take hold when the engine must pull, but let go for over-riding This feature is called "free wheeling," and has many variations

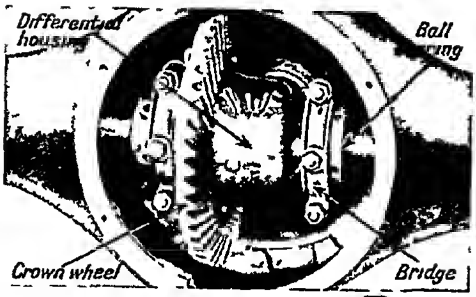


Fig 11 Back axle of a car with differential gear in a cage which carries the crown wheel

Rear Axle and Differential Gear—Up to this point we have been concerned only with the mechanism that carries the power to the propeller shaft In order to make the wheels go round we must have some means of making the rotating motion of this shaft "turn a corner" and rotate the axles The differential (Figs 11, 12, and 13) accomplishes this purpose The crown wheel A is driven by the bevel pinion B, the crown wheel being bolted to a flange on the

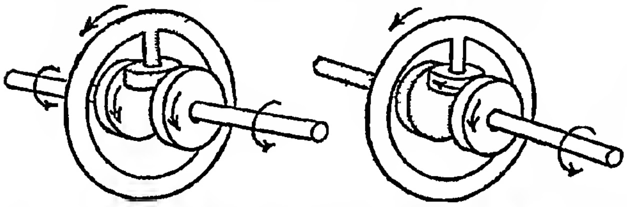


Fig 13 This illustrates the principle of the differential Left, both axles free, when the bevel pinion cage is rotated both are driven If one is held or retarded it acts as a fulcrum around which the bevel pinion "climbs"

differential box or cage C, which rotates on the same axis as the axles D and E, but quite independently of them The differential box carries two or more bearing pins F, on which the two small bevel pinions G are mounted These pinions are capable of independent rotation on the pins F, but are both in mesh with the larger bevel wheels secured on the ends of the axles D and E The pins F are usually integral with a central spider H

As long as the axles D and E rotate at the same speed, owing to the car travelling in a straight line, there will be no rotation of the pinions G on their pins F, the whole being rotated as if solid by means of the crown wheel A, bolted to the differential box C The drive is, however, transmitted through the pinions G to the differential wheels all the time, the two wheels being balanced by their engagement with opposite sides of the pinions For this reason the term balance gear is often used

When the car turns to the right or to the left, one of the axles D, E will have to turn more quickly than the other, owing to the road wheel which it drives being on the outside of the curve When this takes place, it will be obvious that the two small bevel pinions G will have to rotate on their pins F, while one of the bevel wheels is turning faster than the other One of the axles then rotates faster than the differential cage, and the other more slowly

Brakes—Two types of brakes are in common use These are the mechanical and hydraulic systems Fig 14 shows the construction of the mechanical type, while the interior of a typical hydraulic brake is shown in Fig 15 The brake drums on each of the wheels are of practically the same construction The hand or parking brake may be connected either to the

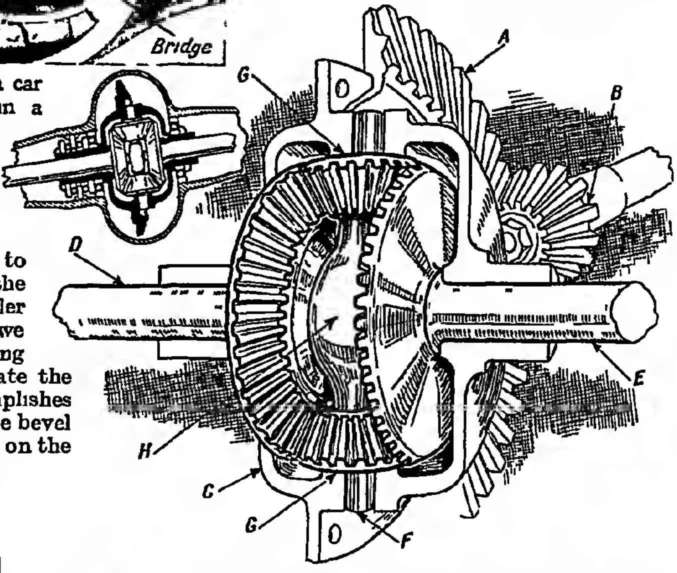
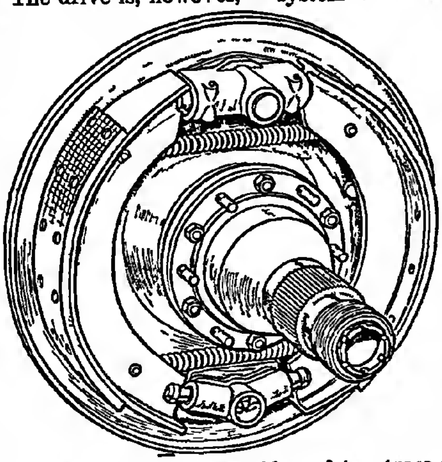
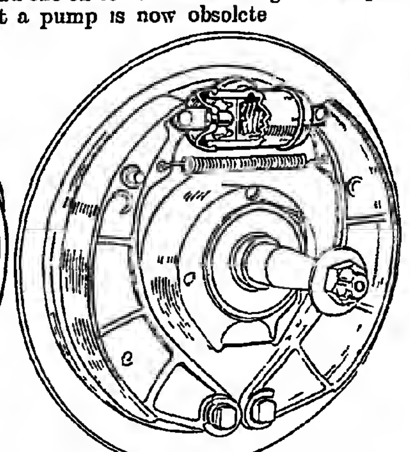


Fig 12 Cut-away view of orthodox bevel differential gear The small view shows how differential casing is mounted to run as a unit in axle casing

wheel brakes, or to a special drum on the propeller shaft behind the transmission It serves to lock the wheels so that the car will not move when parked on a slope Hydraulic types transmit pressure to the drums through a series of tubes, pistons, and cylinders They usually have a solution to prevent freezing

Lubrication—The lubrication of motor-car engines is invariably carried out by a combination of the "forced feed" and "splash" methods In the latter, a supply of oil carried in an oil pan below the crankshaft is maintained at a definite level in small troughs, one below each connecting rod On the bottom, or bearing cap, of the rod is a small spoon or scoop, which dips into the oil at each turn of the engine A part of the oil is driven up and into the bearing, the surplus splashing on to the cylinder walls and into other troughs placed to catch and lead the oil to various bearings This splash system without a pump is now obsolete





Here are the drum assemblies of two types of brakes Fig 14 (left) shows the Girling mechanical brake, Fig 15 (right) the Lockheed hydraulic

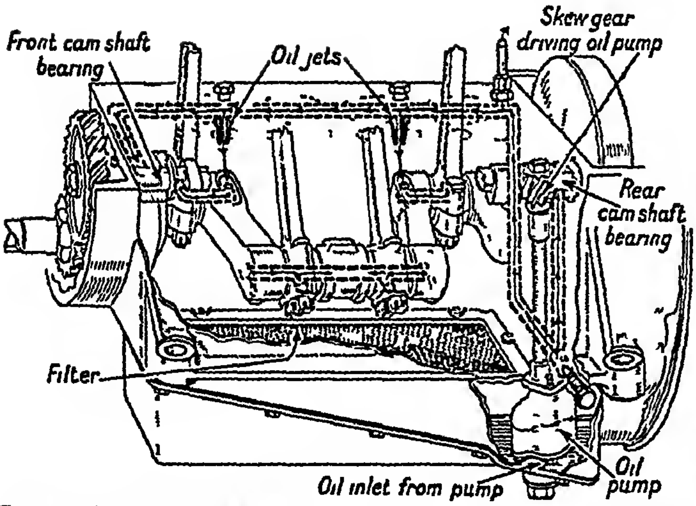


Fig 16 A combined splash and pump lubrication system as incorporated in a four-cylinder engine The passage of the oil is clearly indicated

A method of supplying oil to the various bearings by a combined "splash and forced feed" system is shown in Fig 16 The oil from a gear wheel type pump is led through a passage up to small jets which discharge it into pockets on the crankshaft webs during the rotation of the crankshaft Each jet supplies two pockets, and the oil from each pocket is led to the adjacent big end bearing Oil is also supplied direct to front and rear camshaft bearings A considerable amount of surplus oil is splashed about the crankcase and forms an oil mist sufficient for the lubrication of the pistons and the gudgeon pin bearings All the surplus oil runs down into the sump through a filter or strainer extending from one end of the engine to the other

THE DYNAMO —Cars were originally started by hand and many injuries, such as broken arms from kicking engines, resulted The first successful electrical starting, lighting and ignition system was developed about 1913 This method, much simplified, is still in general use The heart of the system is the accumulator or storage battery

The dynamo is used to charge the battery and so furnish current to the ignition circuit, the lights, and similar units When the engine is running at ten miles or more per hour, the current is drawn from the dynamo, and the current is sent to the battery, there to recharge it The electrical system on the car uses direct current, because alternating current cannot be used for charging a battery Car dynamos usually have a voltage of 6 or 12

If no current were generated, the battery, being connected to the dynamo, would send current through it and would be exhausted quickly To prevent this, a cut-out is inserted in the circuit This will disconnect the dynamo when its output voltage is too low When the voltage rises to the proper value, the cut-out puts the dynamo in circuit, and a current is sent to the battery to recharge it

STARTING MOTORS —Modern cars are cranked by automatic starters In some types when a switch, moved by hand or foot, is closed current passes to the starter motor which immediately revolves and a pinion engages the flywheel gear An over-running clutch releases the starting mechanism as soon as the engine gets under way

In the Bendix starter the shaft of the motor is attached to one end of a spring The other end of the spring is fastened to a threaded sleeve which "floats" on the motor shaft The spin of the starting motor turns the threads inside the pinion, forcing it into engagement with the flywheel But the instant the engine takes hold, its greater speed forces the pinion back on the thread and so out of engagement with the flywheel

THE IGNITION CIRCUIT —Formerly almost all car engines were supplied with magnetos which generated and delivered a high-tension spark to the sparking plugs to fire the compressed gases within the combustion chamber These were bulky and had certain disadvantages but with the perfection of the electrical system, a new form of ignition unit was developed This is the battery-and coil ignition (Fig 17) This unit is made up of several parts One is a primary circuit which makes and breaks the primary current, thus sending to the coil interrupted charges of primary current at twelve volts The other is the distributor unit, which distributes the high tension spark which is returned to the unit from the coil at 15,000 20,000 volts In the ignition circuit, primary current comes from the battery or dynamo to the distributor points These alternately make and break the electric circuit when struck by the rotating cam, the current thus goes through the coil in interrupted spurts and there passes through the primary winding This action builds up, within the secondary winding of the coil, high tension current which is returned to the central portion of the distributor cover, and by means of a revolving rotor is distributed to the leads running to the individual sparking plugs, according to the firing order of the engine A wire from each sparking plug leads to the points in the cover

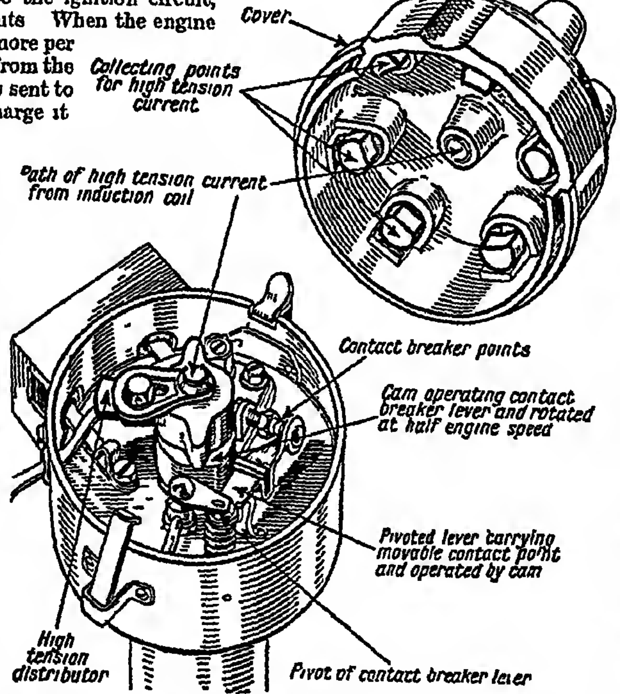


Fig 17 Typical distributor and contact breaker for six cylinder engine using coil ignition

LIGHTING SYSTEM —The great amount of light secured from the ordinary small bulb used in the headlamp (Fig 18) is due to a parabolic reflector of highly finished surface This gives a very bright beam which must be controlled to prevent a blinding glare

There are two essentials to proper headlights The correct lenses should be used, and the lamps must be in focus to spread the beam over a wide portion of the roadway, showing up hedges, pedestrians, and other vehicles No beam should be allowed to come from the headlamp at a point higher than the centre of that lamp, the highest rays should be parallel with the road surface, and not above this line A dipping or dimming device must now be fitted by law, and the Highway Code enjoins its use whenever meeting other traffic at night

SUSPENSION SYSTEM —When a car is travelling

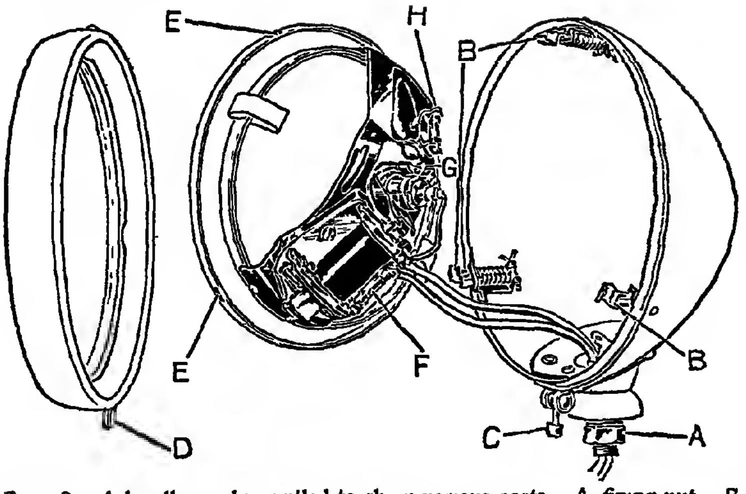


Fig 18 A headlamp dismantled to show various parts A, fixing nut , B, reflector supports , C, front fixing screw , D, fixing slot , E, slots in reflector rim , F and H, fuses G, bulb holder clip

along a road, the body and all the parts of the chassis except the axles and wheels should travel in a uniform manner without any noticeable up-and-down movements The surfaces of all roads are, however, very irregular, some much more so than others, and as it is necessary for the tires to follow the contour of the road surface, springs allowing considerable freedom of movement must be interposed between the frame and the axle

Pneumatic tires are provided to absorb shocks due to small irregularities such as stones, but springs are necessary to prevent the transmission to the frame and body of shocks due to the larger unevennesses such as bumps and pot-holes Hitherto the majority of cars have been provided with four laminated semi-elliptic springs , that is, each consisting of a number of steel leaves Cantilevers, quarter elliptic, and other arrangements are, however, also used Fig 19 shows three common arrangements of front and rear springs The front spring shown at A is pivoted at its front end to the dumb iron, and is shackled at its rear end to the frame, while the front spring shown at B is connected to the frame in the reverse manner The rear spring shown at C is pivoted at its front end to the frame and is connected by a shackle at its rear end

Independent wheel suspension employing coil or leaf springs is being increasingly used in modern design, and is incorporated in a number of British cars

Mountaineering.

Although you may do a certain amount of mild "scrambling" during your summer holidays, on the seaside rocks or in the hills of such regions as the Lake District, this is really a sport in which you will not take an active part until you are grown up, and even then it requires certain qualities which not everyone possesses The first of these, if you aspire to be a serious mountaineer, is a good "head" If you can't stand heights, don't try mountaineering There is nothing to be ashamed of in this, for many people otherwise brave enough are quite incapable of looking down from even small heights, and even airmen who are quite at ease twenty thousand feet up, may be incapable of gazing at a fifty-foot drop when clinging to rocks

Given a good "head," reasonable strength, and, above all, physical fitness, you may take to mountaineering It is not a very old sport, dating, in an organized way, from the 16th century, when a club was formed in Zurich, but it was little practised till two centuries later Of the famous mountains, Mont Blanc was first conquered in 1786, and since then other famous Alpine peaks were climbed one by one Finally, in 1857-58, the Alpine Club was founded, and mountaineering as a real sport came into being It extended to Norway, Corsica, the Caucasus, then to the greater mountains of America and Asia, and, in 1921, to Mount Everest (*q v*) The Swiss, born mountaineers, were joined by the English and Germans, and these two races have probably done more than any others to forward this great sport

Rock-Climbing in Britain

From the practical point of view, mountaineering has two quite definite branches, rock-climbing, and snow and ice work It is possible, too, to be an expert in one of these without having done more than a very little of the other In England, especially, we have far more opportunities for rock-climbing than for snow and ice work, and, indeed, some of the world's finest rock-climbs are to be found in Britain In England the Lake District, and in Wales the region round Snowdon, are the best climbing centres, while in Scotland there are many fine centres throughout the Highlands

The most difficult rock-climb in Britain is generally supposed to be the Crowberry Ridge on Buchaille Etive, near Glencoe , but in the Isle of Arran, in the Firth of Clyde, there is a climb on Ben Nuis that has only been done once, and that in 1901 It was not until *1873* that the highest peak in the island of Skye was climbed

One essential in climbing is to have some knowledge of the actual rock, for while some types, like the granite and basaltic rocks of the Lake District, will take a great strain and are not likely to break away, others are treacherous, some *e g*

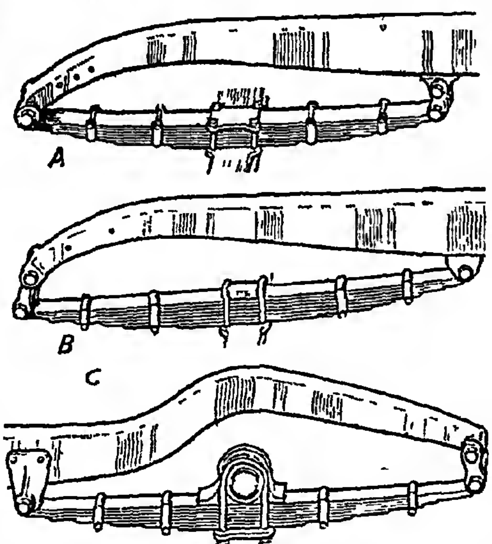
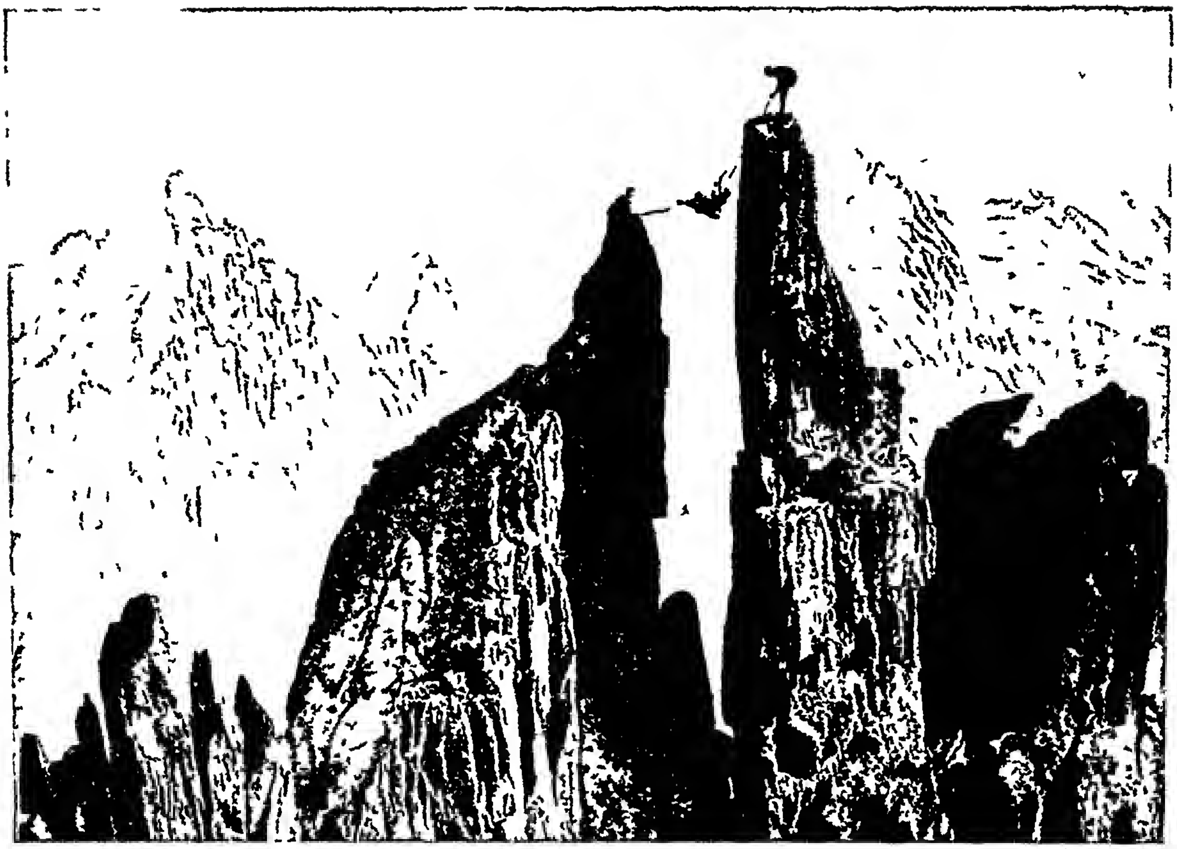


Fig 19 Showing A and B, semi-elliptic front springs , C, rear spring

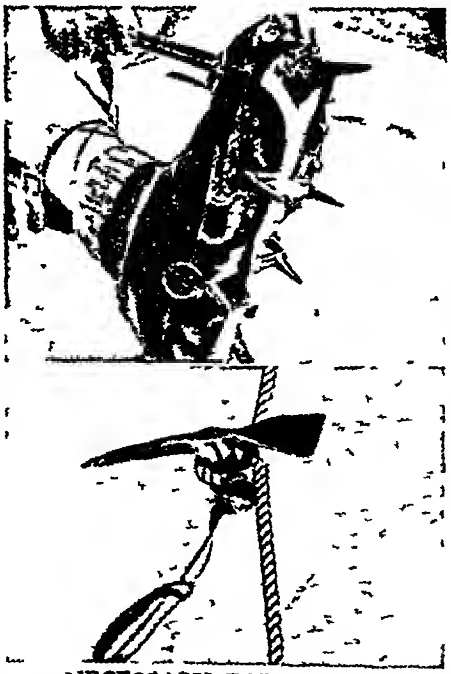


B Burford

PERILOUS POSITIONS BUT SIMPLE TO THE MOUNTAINEER

The trained mountaineer takes as matters of course deeds which we should expect to see accomplished only by the trained artists of the circus, here, for instance, are three men engaged in a typically dangerous-looking piece of climbing One, having reached the higher pinnacle, is hauling the second man across on a system of ropes, while the third steadies the far end This is taking place in the French Alps Mont Blanc lies hidden in the clouds to the right of the picture

in limestone districts, are too soft even to permit of real climbing at all Rock-climbing is generally done roped, three being the usual number of climbers on a rope All intending climbers should learn the special knots used in fixing the rope The system, which is that followed in all climbing, is for the leader to go ahead, then to take the middle person up to him He then goes on again, and the man in the middle waits while the third person comes up The middle then goes on, then the first, then the third again, and so on The least experienced member of the party is usually put in the middle, the most experienced leading, the strongest—if all things are otherwise equal—coming at the end The rope (which is specially made, and can be distinguished by a red thread



NECESSARY FOR SAFETY

At the top is shown the correct way to fasten the "crampons"—spikes by means of which the mountaineer can walk on the steepest ice and below, the head of an ice-axe is stuck deeply into the snow as a support for a rope

Swiss Federal Rlys

running through it), though strong enough to bear easily the weight of a man under normal circumstances, is not used to haul persons up, but merely to steady them so that they can devote their whole attention to climbing, and to save them from falling should they slip For rock-climbing on certain kinds of rock, such as the gritty sandstone of Tirol, rope-soled shoes are used, but for general work proper climbing boots, with special nails which grip the edges of the soles and give a hold on the rock, are worn

The ice-axe is an essential of snow and ice work It is used for cutting steps in the ice—a long and difficult job on which depends the whole safety of the party—for testing the depth of snow, the strength of snow-bridges, and for finding out where crevasses are, and where the

snow is likely to be treacherous The leader of a party on snow or ice must be able to do all these things, and he must, too, be able to tell what sort of conditions are likely to lie ahead whether the snow is safe, and will still be safe when a descent is being made, whether it is likely to avalanche, or to freeze up, and, also, what the weather is likely to do, for on this a great deal depends Long and difficult climbs on snow or ice are started at night, to ensure good conditions on the way back, and it is not unusual for the party to reach its goal in the early hours, returning before the sun has begun to melt the snow and made conditions difficult and treacherous Many a life has been lost through neglecting this precaution, and through a party being forced to spend the night on the mountain, and freezing to death *Crampons*, which are sets of steel spikes for fitting to the sole of the boots, are sometimes used for snow and ice work, but they are as much disliked by some mountaineers as they are liked by others

A heavy rucksack is carried only when the party is actually making a climbing tour, going from place to place along a range, for excursions done in one day, the minimum of weight is carried, consisting of food, emergency supplies, and the rope, which is carefully coiled when not in use In winter, mountaineering may actually be combined with ski-ing, but this is indeed an occupation for the expert at both types of sport

Classic Tales of Mountaineering

There is quite a literature about mountaineering in English, and some books on the subject have already won the standing of classics Edward Whymper's "Scrambles Among the Alps" (1871), which is perhaps the greatest of them, tells how the author, after many attempts, was the first to reach the summit of the Matterhorn, and how his companions lost their lives on the descent Sir Leslie Stephen's "The Playground of Europe" (1871), J Tyndall's "Hours of Exercise in the Alps" (1871), and A F Mummery's "My Climbs in the Alps" (1895) tell of other Alpine exploits More recently there has been a spate of writers on mountaineering, of whom one of the most successful, as writer and mountaineer (and photographer), is F S Smythe In the pages of these and other authors we can follow the course of their exploits, feel something of their toils and dangers, and even share that wonderful feeling of exhilaration that comes at the end of a long and strenuous climb

Mountains. Although a mountain is usually thought of as a peak of land rising to a high level above the surrounding country, isolated mountains are rare, the peaks being usually but points in long parallel ranges, which extend for many miles as gigantic folds or tucks in the surface of the earth

The loftiest mountains of the world are arranged with remarkable uniformity in two great belts, one constituting a "world girdle" and surrounding the Pacific Ocean, bordering four of the great continents, and the other extending in an east-west direction in Eurasia The fact that mountains occur generally near the borders of continents suggests that the settling of ocean basins due to the shrinking of the earth over a cooling interior may have


Planet News

MAPPING IN THE MOUNTAIN SNOWS

Like black midgets at the foot of this rugged peak, the map-makers attached to a Russian scientific expedition trek across the eternal snows of the Tien-Shan range The mountains which they are exploring form the boundary between Mongolia and the Kirghiz Soviet Socialist Republic

HARVEST MICE PLAYING PRANKS IN THE CORN

It is a pity that these little harvest mice are so destructive to the farmer s co-n, for they are among the most dainty and attractive of all our wild creatures Their fondness for the grain on which the farmer expends so much care and money, however, more than counterbalances in his opinion their appearance As shown here they not only feed among the corn but also make their home there—a neat little ball of grass blades woven cunningly round some of the tall upright stems

LONG-TAILED MICE

THE cheeky little creature seen in these pictures is a long-tailed field mouse, also known, less correctly, as the wood mouse It is probably the most common of the outdoor mice, and may be the source of the grasshopper-like chirping that is often heard breaking the stillness of the evening in the fields The individual on the right has built its nest—larger but less tidy than that of the harvest mouse in the colour plate overleaf—in a somewhat inaccessible position Though this makes for safety, it also involves the rodent in leaps that are rather long for its three and a half inches The nest is made of grass mosses, and leaves

Photos top J J Ward right George Hearn

been one cause of their origin High mountains exist also submerged in the sea, many chains having been discovered in the Pacific and Indian Oceans The loftiest mountains in the world are the Himalayas, the highest peak being Mount Everest (29,002 feet)

Mountain ranges have been formed in several ways All the great ranges are the result of "folding," a gradual upheaval due usually to some great pressure on the sides, which bends the rock layers upwards like an arch Occasionally the rocks do not bend but break, or "fault," producing mountains which are steep and cliff-like on one side, with gentle slopes on the other Many mountains owe their existence to the gradual work of rivers in dissecting a plateau, leaving the hard rocks standing in bold relief Then, finally, volcanic cones are formed by lava eruptions

In the formation of many mountains all four processes have had a part As soon as mountains begin to rise, erosion commences and continues until they are worn down to a plain, unless they are again uplifted All lofty mountains, like the Himalayas, the Andes, and the Rocky Mountains, are comparatively young The African mountain ranges are in a mature stage, and the Laurentian Plateau of Canada, now worn down almost to a plain, has reached old age Some of the oldest mountains of the whole world are those in Scotland, in Skye and other islands of the west

Mountains greatly decrease the habitable area of land by their own ruggedness, and also by the aridity to which they often give rise on one side by causing the winds to drop most of their moisture before passing over them On the other hand, however, they are the source of the great rivers, and they furnish many minerals

Lofty mountains have been almost as effective as the oceans in serving as barriers to the movement of men and animals and the spread of plants No railway has yet been laid across the Himalayas, which for ages have separated India and China from each other, and until 1910 no railway crossed the Andes The Pyrenees shut off Spain from Europe so completely that it is often said, "Africa begins at the Pyrenees", and for centuries the Alps acted as a barrier between Italy and Germany Because of this separating tendency, and the protection which they afford from invasion, mountains frequently serve as well-defined political boundaries between countries

The LITTLE MOUSE *as* PEST *and* PET

The "wee, sleekit, cow'rin', tim'rous beastie" with whom Robert Burns felt such sympathy is at the same time a destructive pest, which, without the aid of its natural enemies, Man would find difficult to control

Mouse. Here are some verses about the mouse you may not know

All dressed in grey, a little mouse
Has made his home within my house,
And every night, and every morn,
I say, 'I wish that mouse were gone"
But why? A quiet soul is he
As anyone may wish to see

My house is large, my hearth is wide,
There's room for him and me beside
Ah! yes, but when the lights are out
He likes to slyly creep about,
And help himself to what he sees,
Without once saying, "If you please'

Perhaps we shouldn't mind it so much if this little rogue came singly, but the mouse is a social animal and likes to have his family with him And his family is not only large, but it constantly increases

Mice usually have six families a year, and there are about six baby mice in a litter, and the young mice breed when they are four months old Therefore, if a pair of mice enter a home and have good luck and no deaths in their family, under normal conditions they increase in a year to from 300 to 400, and at the end of the second year they number 50,000 or more Fortunately, the mouse has plenty of foes, while where there are many rats the mice are usually few, being unable to compete

The house mouse (*Mus musculus*) was probably a native of Asia, but it is now found

CORNERED!

Unwise enough to come out in daylight, this little house mouse has been trapped in a corner by the photographer Notice the bright eyes, rounded ears, and long, naked tail of this destructive but entertaining little creature

Photo J Markham

in every part of the world, wherever human beings have their habitations It not only helps itself to our food, but it destroys or damages books, pictures, clothing, and furniture True "white" mice are albino examples of the common house mouse

Besides this species we have several others in Britain, of which the commonest is the long-tailed field-mouse, often called the *wood mouse* (*Apodemus sylvaticus*), which can be distinguished from the house mouse by its longer tail, it is common in England in fields and gardens In the winter it sometimes comes into houses It is reddish-grey with light brown on the chest It increases very quickly and does a great deal of damage, hoarding in its burrows for its winter food large quantities of corn and seeds There are a number of sub-species similar to this

A very pretty and tiny mouse is the harvest mouse (*Micromys minutus*), first identified in England by the naturalist Gilbert White It weighs about $\frac{1}{6}$ of an ounce, and is yellowish red in colour It lives in the fields, making a round nest hanging high among the corn-stalks, and is frequently found in corn-ricks, where it does damage by eating the grain The dormouse is not a true mouse and is described under its own heading (*See* page 1301)

Mice represent the smallest members of the great family known as rodents, or gnawing animals They are harmful because of their numbers and their rapid increase However, they have many natural enemies—hawks, owls, crows, shrikes, cats, weasels, etc If it were not for this fact it would not be long before they overran everything

How the Mouse Became so Small

Cuddled in a nest he had made for it with his handkerchief

SUMMER had come again, and Peter was very glad As he lay on the grass in the shade of a leafy oak tree by the side of Uncle John's cottage, he suddenly noticed that something was stirring in the grass not a foot from his nose It couldn't be a cricket—it was too big for that He reached over, ever so carefully, and closed his hand quickly upon the clump of grass It was a mouse—a teeny-weeny little mouse—that he held in his hand! And it had the daintiest little white feet and the prettiest little pink nose—with funny whiskers on it! Wide-awake now, he turned to Uncle John, who was dozing in a chair by his side

"Look, Uncle!" he cried excitedly "Just see what I've caught!"

"Eh—what?" cried Uncle John, starting up and dropping his pipe "Oh, yes! A little field-mouse, pretty, isn't it? There are lots of 'em about these fields and woods"

"I think it's *lovely*," said Peter "I'm going to take it home and make a little cage for it and keep it for a pet Don't you know any story about mice, Uncle?"

"Well, yes, I do," said Uncle John, wrinkling his forehead as he picked up his pipe "Let's see There's the story about the mouse that freed the lion from the net in which he was caught—but that was another kind of mouse, I should say And there's the one about the mouse that frightened the elephant almost to death, and the story about the Town Mouse and the Country Mouse But these were just quite ordinary house mice, no doubt But there's a Red Indian story about how the mouse grew so small, and I expect that's this kind of mouse Want to hear that story?"

Of course, Peter said yes, and Uncle John began

"Once upon a time, there was a Red Indian boy and his sister who lived all alone, because their parents were dead The little girl took care of the wigwam and did the work, and the boy hunted with his bow and arrows One winter he shot a lot of snowbirds, and his sister made a beautiful coat for him out of their skins

"When summer came the boy said 'I'm going to visit my mother's people, who live far away to the west, beyond the distant hills' So he took his bird-skin coat and set out The ground was soft and springy, like it is today, and a warm wind blew over the plains By and by the boy grew tired and lay down on a little hill While he slept the sun grew hotter and beat down fiercely upon him His fine bird skin coat shrivelled and shrivelled in the heat, and soon it was no bigger than a baby's coat

"When the boy awoke he was very angry with the sun His fine coat was ruined, and now he was ashamed to visit his mother's people He went back home, and for weeks he was so sad that he could scarcely eat anything his sister cooked for him

"Then one day he asked her to make a hunting snare for him She made him one of deer sinews, like the snares used to catch rabbits But he said it was not strong enough Then she

made him one out of rawhide rope, cut from a buffalo hide But he said that was too heavy and coarse At last she cut off her long black hair and braided it into a fine strong cord With a noose made from that the boy was satisfied Next day he set out, without telling his sister what he meant to do He travelled many days, over hill and dale, carrying as his only luggage the hunting snare his sister had made for him and a little package of food At last he came to the Great Water that lay to the east It was summer in the North Country and the sun rose early The boy placed his snare just where the sun would touch the land when it first rose at dawn from the sea

"Sure enough, as the sun rose out of the sea next morning and came to the edge of the land, it was caught and held fast in the snare that the boy had set 'Now,' said the boy, 'I have punished the sun for ruining my bird-skin coat' And he went back to his home on the plains

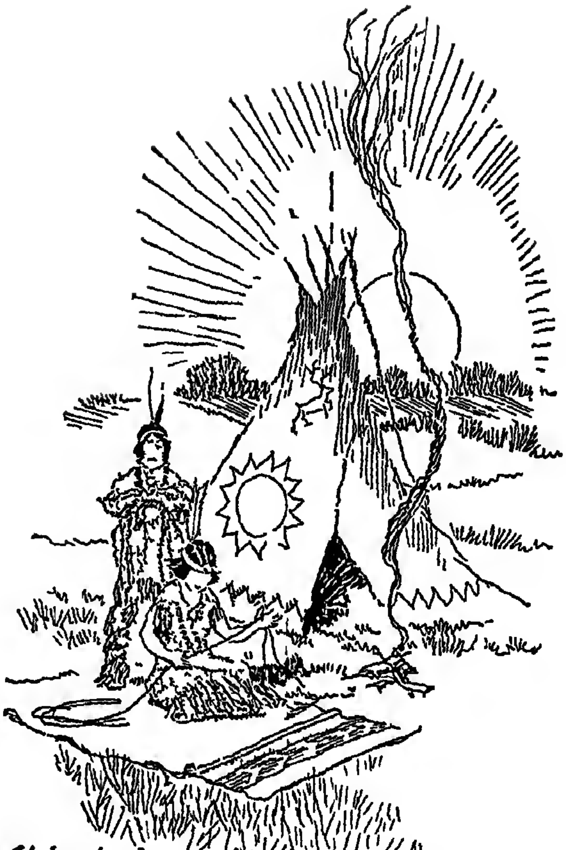
"He did not say anything to anybody He just kept as quiet as he could and waited to see what would happen now that the sun was fast in the snare

"All that day the sun did not rise above the horizon It was twilight all over the land The animals were in great fear and wonder Only the owl and the beasts that roam by night came out to look for food

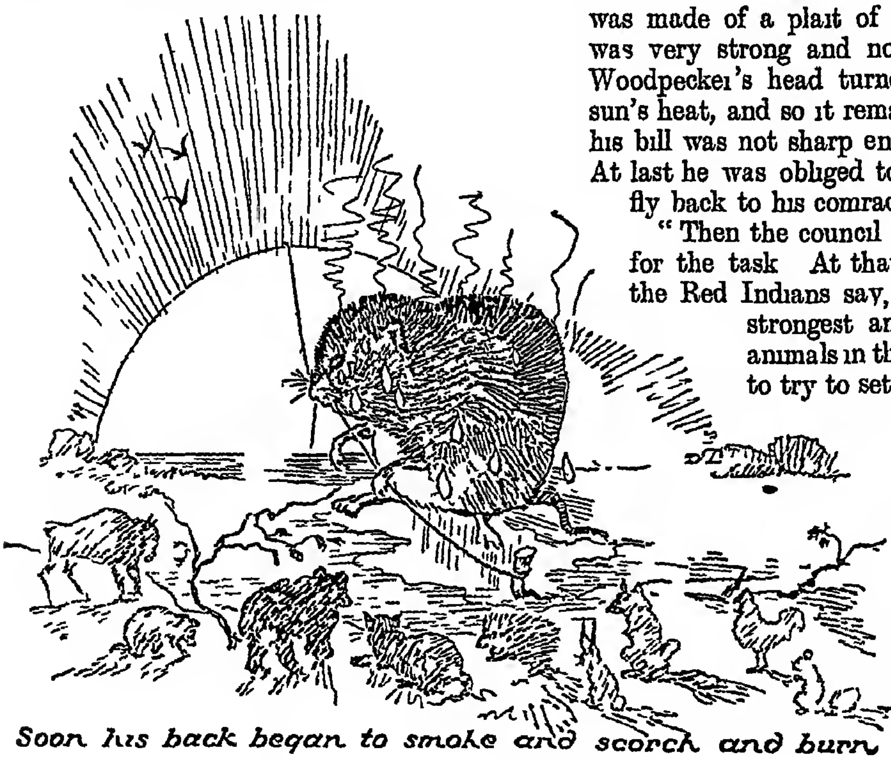
"At last the birds and beasts called a council to see what could be done When they found that the sun was tied to the earth by a snare they decided that someone must cut the cord But the sun's heat was so great that whoever ventured near enough to do this might be burned to death The birds and beasts drew lots to see who should make the attempt, it fell to the Woodpecker He flew bravely to where the sun lay bound and pecked and hammered at the cord as hard as he could But the snare was made of a plait of woman's hair and it was very strong and not easy to cut The Woodpecker's head turned fiery-red with the sun's heat, and so it remains to this day But his bill was not sharp enough to cut the cord At last he was obliged to give up the task and fly back to his comrades

"Then the council called for a volunteer for the task At that time the Mouse, so the Red Indians say, was the largest and strongest and bravest of all the animals in the world So he offered to try to set the sun free

"The Mouse's sharp teeth were better fitted to cut the cord than was the Woodpecker's bill Still he thought he never would get through with the job The heat was very great, but he was ashamed to leave his task unfinished So he stuck



At last she cut off her long black hair and braided it into a fine strong cord



Soon his back began to smoke and scorch and burn

to it, gnawing the cord with his sharp teeth, and cutting one hair at a time And the hotter he got, the harder he worked, while the other animals held their breath with excitement

"Soon his back began to smoke and scorch and burn Then he began to melt away under the terrible heat, and he grew smaller and smaller When the whole top of his body was burned to ashes, and he had shrunk from the largest animal in the world to one of the smallest, the last hair gave way and the sun bounded up into the heavens All the animals cheered, for the Mouse had saved the world!

"But ever since that time the Mouse has been one of the tiniest of animals and one of the most timid And his back has always been the colour of grey ashes, because he was scorched so badly in setting the sun free"

Uncle John ended his story He looked up at the sun, smiling down at them from the sky, and nodded as he lighted his pipe

Peter looked at the tiny field-mouse, cuddled in a nest which he had made for it with his handkerchief Then he sighed and said

"I s'pose that's just a fairy story But, anyway, I don't think I'll make a cage for my mouse, I'll let it go"

With that he put the trembling mouse gently down on the ground For nearly a minute he could see the grass waving as the little creature scampered happily away to its hidden nest and babies Then all was still again

Mouth Organ. Every boy and girl, no doubt, has tried to play a mouth organ Known in some parts as the harmonica or "French harp," this simple instrument is inexpensive, and children can learn to play it with very little musical instruction

The mouth organ is a wind instrument The notes are produced by tiny strips of metal which fit into holes in metal plates fastened to each side of a strip of wood The strips are left free at one end, so that they vibrate when the player blows into the instrument or sucks in his breath Strips of different lengths produce the different notes

Mozart, Wolfgang Amadeus (Pron mō'-tsaht) (1756–1791) A winning child genius, petted by sovereigns and princesses, a brilliant youthful composer, acclaimed by his peers as "the musician of musicians" and "the only *musician* in the world"—the artist-drudge of a penurious emperor, harried by debt, privation, and overwork to an untimely death, and allowed through cold neglect to go unattended to a pauper's grave—such were the strange contrasts in the life of the "divine" Mozart

He was born at Salzburg, Austria, where his father was musical director for the archbishop At the age of three he displayed such interest in the music lessons of his elder sister that the father, a thorough musician, began to give the boy regular daily lessons When five he not only played the harpsichord well, but had also composed a number of short pieces When seven years old he went with his family on an extended musical tour, and became a general favourite on account of his playing and his engaging manners and appearance

WOLFGANG MOZART
Mozart's music is distinguished by its beautiful melody He was one of the greatest composers of all time, and his work formed an important contribution to the advance in orchestral music and to the development of opera

He was a very sweet, innocent child When he slipped on the polished floor of the emperor's castle in Vienna and was picked up by beautiful Marie Antoinette, later queen of France, he said "You are very kind, when I grow up I will marry you"

Everywhere he won great applause by his organ and violin playing From Paris he was taken to London, where his playing amazed all who heard him During his stay of over a year in England he composed ten sonatas for the clavier (an early form of the piano) and violin, six of which were published

When thirteen years of age Mozart was taken to Italy, and for two years travelled from city to city giving concerts In Rome he was taken to the Sistine Chapel to hear a famous musical composition of which no copy had ever been published After hearing it once Mozart was able to write it out entirely from memory

In Rome the Pope conferred upon Mozart the Order of the Golden Spur, making him, at thirteen, a "chevalier" or knight When in

MOZART WINS THE HEART OF ROYALTY

When only seven years old, "Wolferl," as little Mozart was affectionately called, went with his father on a long musical tour and endeared himself to all by his marvellous playing and by his engaging manners and appearance. When he played his violin before Maria Theresa and Francis I at the Austrian court the Emperor was very kind and called him his "little magician"; so little awed was Wolfgang by his surroundings that he jumped on to the Empress's lap and gave her a kiss.

Painted specially for this work by DUDLEY TENNANT

MOZART'S LAST HOURS

THE end of the great Austrian musician was tragic He had been commissioned by an unknown stranger to write a Requiem (grand musical composition played in honour of the dead), and as he did so he became convinced that he was writing his own Requiem He worked frantically to complete it, for he feared that he would die before it was finished Hour after hour he would sit propped up in his chair, his soul lost in his most noble composition Mozart's premonitions came true, and he did not live to complete the work Strangest of all, the mysterious stranger never called for the piece he had commissioned

Milan he composed an opera which was so popular that it was sung for twenty nights in succession After his return to Salzburg Mozart was twice recalled to Italy to direct his compositions for special occasions

For the next thirteen years he gave concerts and composed The list of his compositions is very long, including operas, symphonies, masses and other forms of sacred music, besides numerous smaller pieces

Famous, but Far from Rich

At the age of twenty-six Mozart married During the next five years some of his finest compositions were produced, including "The Marriage of Figaro" and "Don Giovanni," two of his finest operas But although these were received with the greatest enthusiasm, the financial recompense to Mozart was comparatively small The emperor appointed him to a position at the Austrian court, but the salary was low His wife was extravagant and a poor business manager, and Mozart found it demanded all his powers to keep his growing family from want To make ends meet he took pupils and produced numerous compositions

Under the strain his health began to fail During the year 1791 he was engaged on three of his greatest compositions Besides two operas, he had received a commission to compose a requiem or funeral service, the purpose of which was kept secret The mystery surrounding this order made a strange impression on Mozart, for in his weakened condition he became convinced that it was his own requiem that he was composing

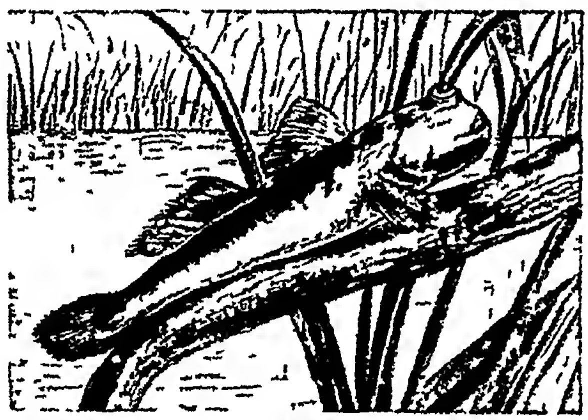
Such it proved to be, for just before it was finished the busy brilliant life of Mozart ended, apparently from typhus fever There were debts, and there was no money His wife was ill, and no friends came to help So his body was hastily buried in a pauper's grave in one of the cemeteries of his beloved Vienna

Of Mozart's operas "The Magic Flute" is perhaps his best Of his many symphonies the one known as the "Jupiter" symphony is by many considered the finest, and is so masterly that it is difficult to believe that it was composed in fifteen days His quartets are equalled only by those of Haydn and Beethoven His sacred music is beautiful The "Requiem" has been used in the funeral services of many great musicians

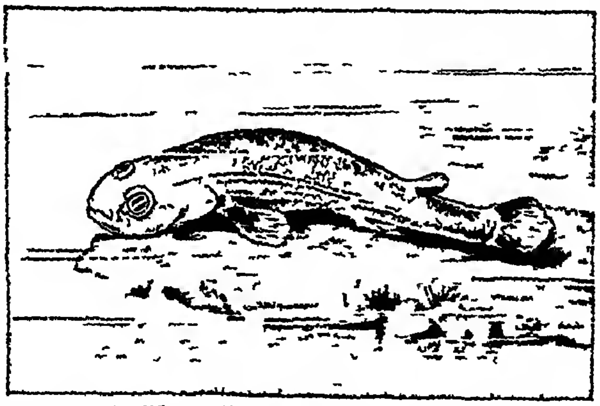
Mud-skipper. A strange contradiction to the everyday rule that fishes cannot live out of water is the "mud-skipper" of East Indian rivers He is a tiny creature, with front fins developed like the flappers of a seal, who comes out on the shore and hops about, hunting for small insects Other sorts of mud-skippers are found on the Great Barrier Reef of Australia One such is so adapted to air-breathing that he will drown if kept *under* water—which gives a clue to the way fishes may originally have taken to the land

Then, again, there is the "four-eyed fish" of tropical America, so called because his eyes are divided into two parts—the upper lens suitable for sight in the air, the lower for use in the water He swims half in and half out of water, and is able to see insects above or below the surface When alarmed, this fish will skip like a grass-hopper, two feet or more at a jump

Another strange fish of this group is the little Alaskan blackfish He dwells in the swamps, and his vitality is great It is said that, after being frozen for weeks and then thawed out, he is as lively as ever



Above is a real oddity of the fish world—the "mud-skipper," or East Indian goby He well deserves his nick-name, for he often climbs out upon a convenient log or upon the shore and hops about on his front fins hunting for insect food



STRANGE FISH THAT LOVE THE MUD

This "four-eyed" fish is very queer Do you see how his eyes are divided? The upper half is for seeing things in the air, and the lower half for seeing things under water, for this fish swims with his head half out, ready to jump after any flying insect or dive after any water bug

Mulberry. Without the mulberry tree we should have none of the exquisite silks of commerce, for the silkworm does not thrive or produce the finest quality of silk filaments for its cocoon unless it has as its food the tender leaves of this tree Mulberries are found in temperate regions and are cultivated

for silk growing, for fruit, and for ornament There are three well-known species, red, black and white, named from the colour of the fruit

The white mulberry (*Morus alba*), the one most used in silkworm culture, is a native of China The chief centres of its cultivation and of silk growing are China, Japan, India, France, Persia, and Turkey It has, however, been successfully cultivated in England

The black mulberry (*M nigra*), the fruit-bearing mulberry of Europe, was introduced to Europe, it is believed, from Persia Its large, dark purple, almost black fruit, which looks like a long slender blackberry, is very juicy and delicious

J G Tyler

DELICIOUS MULBERRIES

These are the fruits of the black mulberry, deep blackish purple in colour, they are larger than blackberries, to which they have a superficial resemblance, and make excellent eating

The red mulberry (*M rubra*), a native of North America, has fruit with a pleasing tartness relieving the sweetness characteristic of the fruits of all mulberry trees In some parts of Europe this tree is cultivated in preference to other kinds because of its hardiness A good-sized mulberry tree may be sixty feet in height, with a thick, rugged bole, the wood, when available from a tree of such size, is valuable for furniture making

A member of a closely allied genus is the paper mulberry, the bark of which is used for making paper in Japan The islanders of the Pacific also make a fabric called "tapa cloth" from it by soaking the bark, removing the outer layer, and then laying the remainder on a smooth table and beating it to the required thinness

Mule. When we say that anyone is as obstinate as a mule, we are libelling a very useful animal that is not stubborn It possesses the good qualities of its parents—the strength of the horse and the sure-footedness and endurance of the ass You can always tell a mule from a horse by its long ears

Mules are used especially in the south of Europe, and are raised largely in France In this country they are seen far oftener than formerly They are excellent for military transport, and were much used in the World War, for their size they can pull tremendous loads, and they have a smart, brisk appearance

SIMPLE WAYS *in* MULTIPLICATION

One of the four branches of arithmetic, multiplication often seems more difficult than addition or subtraction, yet it is only an extension of the same idea as addition, as is shown in this article

Multiplication. When a grocer counts eggs three at a time, he says to himself, "3, 6, 9, 12, 15, 18, 21, 24," etc Each of these numbers is called a *multiple* of 3 He is adding three at a time, and the total is made up of threes

Finding the sum of a number of equal numbers is called *multiplication*

When a girl thinks "4 weeks=28 days," she is multiplying To multiply 7 by 4, she must remember the sum of 4 sevens (7+7+7+7) The number multiplied or repeated is called the *multiplicand* 7 is the multiplicand in this example The number of times that the multiplicand is repeated is the number called the *multiplier*, 4 is the multiplier in this example

Harry counts 10 rows of soldiers marching 4 abreast If he knows the multiplication table (Fig 1), he can shorten the process by saying $10\times4=40$ If he should forget what 10×4 equals, what are the multiples that he must say to find the sum of 10 fours? $4+4+4+4+4+4+4+4+4+4$ = what number? What number is the *multiplicand* in this simple problem?

The number resulting from multiplying is called the *product*, 40 is the product of 4 and 10

multiplicand	6
multiplier	5
product	30

Products of large numbers are found by calculating To calculate readily the learner must commit to memory the elementary products shown in Fig 1 opposite

Do without the combinations in lighter type because $2\times3=3\times2$, $2\times4=4\times2$, etc, so the combinations in black type give all the variations necessary Forty-five combinations remain Repeat oftenest the last four lines

(ten combinations in all), as they are the most difficult, namely

6×6	6×7	6×8	6×9
	7×7	7×8	7×9
		8×8	8×9
			9×9

1 1 1	2 1 2	3 1 3	4 1 4	5 1 5	6 1 6	7 1 7	8 1 8	9 1 9
1 2 2	2 2 4	3 2 6	4 2 8	5 2 10	6 2 12	7 2 14	8 2 16	9 2 18
1 3 3	2 3 6	3 3 9	4 3 12	5 3 15	6 3 18	7 3 21	8 3 24	9 3 27
1 4 4	2 4 8	3 4 12	4 4 16	5 4 20	6 4 24	7 4 28	8 4 32	9 4 36
1 5 5	2 5 10	3 5 15	4 5 20	5 5 25	6 5 30	7 5 35	8 5 40	9 5 45
1 6 6	2 6 12	3 6 18	4 6 24	5 6 30	6 6 36	7 6 42	8 6 48	9 6 54
1 7 7	2 7 14	3 7 21	4 7 28	5 7 35	6 7 42	7 7 49	8 7 56	9 7 63
1 8 8	2 8 16	3 8 24	4 8 32	5 8 40	6 8 48	7 8 56	8 8 64	9 8 72
1 9 9	2 9 18	3 9 27	4 9 36	5 9 45	6 9 54	7 9 63	8 9 72	9 9 81

Fig 1

This table is usually known as the multiplication table The facts it summarizes may be more easily remembered if studied in connexion with drawings or other similar constructive work

Cut 100 one inch squares of paper Lay them in rows as shown in Fig 2

1 Count the squares by rows—10 at a time—thus 10, 20, 30, etc

2 How many squares in 3 rows? 7 rows? 5 rows? 9 rows? 4 rows?

3 Copy this table and fill in the blanks

1×10=	6×10=
2×10=	7×10=
3×10=	8×10=
4×10=	9×10=
5×10=	10×10=

4 Lay squares in rows of 5, count them by fives

5 Lay 5 rows of 10 squares each Lay 10 rows of 5 squares each How many squares in each group?

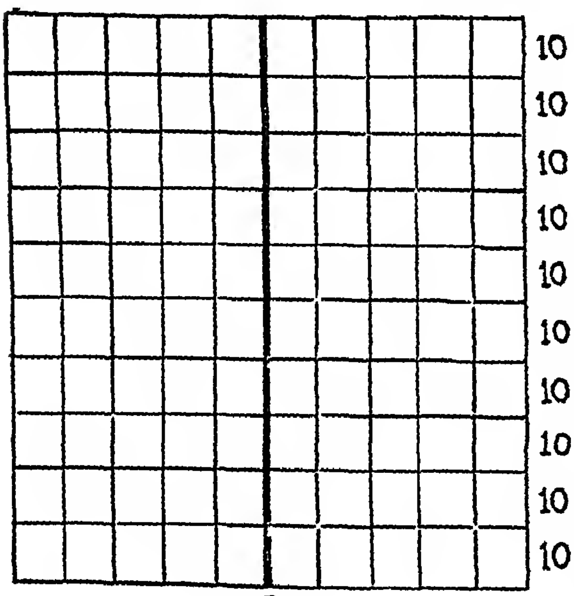


Fig 2

6 Compare 10×5 with 5×10 Fill the blanks 50= — ×5=5× —

7 Cut two strips of paper each 10 inches long and 1 inch wide (Fig 3) 2×10 = what number? Cover these strips with inch squares by placing 2, then 2 more, etc How many twos = 20?

Finish the table by filling the blanks

1×2=	3×2=	5×2=	7×2=	9×2=
2×2=	4×2=	6×2=	8×2=	10×2=

8 Lay 2 rows of 9 squares each 2×9 = what number? Find this number by counting the squares by twos

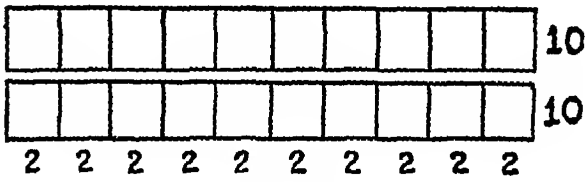


Fig 3

9 Add

1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
—	—	—	—	—	—	—	—	—	—

Complete

2×1=	2×3=	2×5=	2×7=	2×9=
2×2=	2×4=	2×6=	2×8=	2×10=

10 Lay squares to show 10 threes Count 30 by threes Complete the following table of threes to 10×3

1×3=3	3×3=9
2×3=6	4×3=12

11 Show with squares that 3×6=6×3, 3×7=7×3, 3×8=8×3, and 3×9=9×3

12 Complete the following statements by filling in the blanks

3×6= 3×7= 3×8= 3×9=

13 Add

1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
—	—	—	—	—	—	—	—	—	—

14 Lay squares and develop the tables of 4 thus

1×4=4	4×1=4
2×4=8	4×2=8
3×4=12	4×3=12
4×4=16 etc	4×4=16, etc

15 In the same way make tables of 5, 6, 7

16 How many squares on a draught-board (Fig 4)? Count one row Count the number of rows Count the black squares by fours Count the white squares by fours Add 32 and 32 Show that 8×8=64

17 Count 32 by eights Show that 5×8=8×5 Count 48 by eights Show that 7×8=8×7 Count 64 by fours

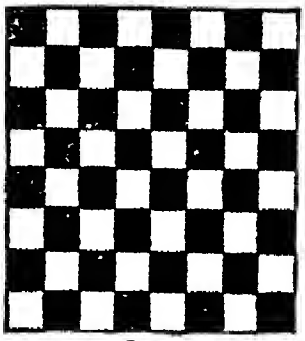


Fig 4

Complete the table below

$1 \times 9 = 9 \quad 2 \times 9 = 18 \quad 3 \times 9 = 27 \quad 4 \times 9 = 36$

18 Show that $3+3+3+3+3=5+5+5$

19 Show that $5 \times 9 = 9 \times 5$, that $8 \times 3 = 3 \times 8$

Principle The multiplicand and multiplier can exchange places without changing the product

Examples

1 Find 2×12 (Fig 5)

Solution	First Form	Second Form
	12	12 $\quad 2 \times 2 = 4$
	12	2 $\quad 2 \times 1$ ten $= 2$ tens
	24 *Sum*	24 *Product*
Answer	$2 \times 12 = 24$	

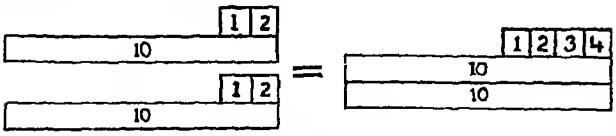


Fig 5

2 Find 2×20 $\quad 2 \times 30$

Solutions $\quad 2 \times 2$ tens $= 4$ tens $\quad$ 2 times 3 tens $= 6$ tens

3 Find 2×27 (Fig 6)

Solution

$$\begin{array}{r} 27 \\ 2 \\ \hline 54 \end{array} \qquad \begin{array}{l} 2 \times 7 = 14 = 1 \text{ ten and } 4 \text{ ones} \\ 2 \times 2 \text{ tens} + 1 \text{ ten} = 5 \text{ tens} \\ 2 \times 27 = 54 \end{array}$$

or

$$\begin{array}{l} 2 \times 7 = 14 \\ 2 \times 20 = 40 \\ \hline 2 \times 27 = 54 \end{array}$$

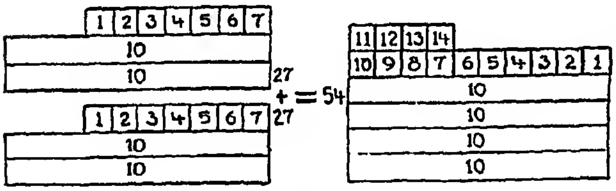


Fig 6

Accuracy and speed in multiplication are acquired in these ways (1) By mastering the "fundamental facts" in tables, (2) by counting with as few words as possible in mind, (3) by writing numbers in straight rows and columns, (4) by forming the habit of testing the correctness of all answers

$$\begin{array}{r} 279 \\ 4 \\ \hline 1116 \end{array} \qquad \begin{array}{r} 713 \\ 402 \\ \hline 1426 \\ 2852 \\ \hline 286626 \end{array}$$

As an illustration of how few words it is necessary to have in mind, the following problem may be used In multiplying 9 by 4, think "36" In multiplying 7 by 4 and adding 3, think "28," "31" In multiplying 2 by 4 and adding 3, think "8," "11"

In writing the partial products be careful to keep units under units, tens under tens, and so on This is particularly important in multiplying by a number in which one or more noughts occur, as in the lower of the two examples on the left

The tests used commonly to determine the correctness of a product are (1) Repeating the operation, (2) changing position of multiplicand and multiplier and multiplying again, (3) dividing the product by either the multiplicand or multiplier The quotient result of the division should be the other factor

To save time in multiplication it is convenient *to know the following short cuts*

To multiply by 10, add a nought to the multiplicand
To multiply by 100, add 2 noughts to the multiplicand
To multiply by 1000, add 3 noughts to the multiplicand
To multiply by 25, add 2 noughts and divide by 4
To multiply by 50, add 2 noughts and divide by 2
To multiply by $12\frac{1}{2}$, add 2 noughts and divide by 8
To multiply by $16\frac{2}{3}$, add 2 noughts and divide by 6
To multiply by $33\frac{1}{3}$, add 2 noughts and divide by 3

Can you invent a short way of multiplying a number by 11? By 99, using subtraction?

The accompanying drill chart will help to fix in your mind the facts of the multiplication table Draw it upon your black board, or upon a large sheet of paper, place a number in the centre for the multiplicand, and give quickly the product as someone points now to one multiplier and now to another Change the multiplicand from time to time

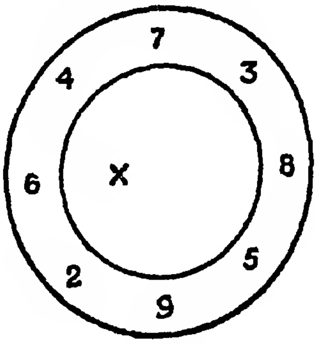


Fig 7

Curiosities of Multiplication

Many strangely symmetrical tables have been developed by students of mathematics One of the most interesting is that which results from the multiplication of numbers consisting entirely of 1's

1×1	=	1
11×11	=	121
111×111	=	12321
1111×1111	=	1234321
11111×11111	=	123454321
111111×111111	=	12345654321
1111111×1111111	=	1234567654321
11111111×11111111	=	123456787654321
$111111111 \times 111111111$	=	12345678987654321

From this we can form a mechanical rule for the formation of such products To multiply a number composed entirely of 1's by itself, write the number which represents the sum of the digits in one factor (which, in order that the rule shall hold must be less than 10), and, symmetrically to the left and right of it, write the digits less than that one, in natural decreasing order For example, to multiply 11111 by 11111, write, 5, the number of digits in either factor, and, symmetrically to the right and left of it, the natural decreasing order of digits less than 5, *i e*, 4, 3, 2, and 1, which give the product 123454321

Other interesting tables are these

7×7	=	49
67×67	=	4489
667×667	=	444889
6667×6667	=	44448889 etc
9×9	=	81
99×99	=	9801
999×999	=	998001
9999×9999	=	99980001 etc.

Multitude, NOUNS OF There are all sorts of strange and unexpected words which one should use when talking of a number of creatures all of one kind

The following amusing rhyme deals with many of these

There's a pride of lions and a sounder of swine and a gaggle of geese all walking in line
There's a spring of teal and a sleuth of bears, and a skulk of foxes bound for their lairs
There's a building of rooks and a wiek of snipe, and a paddling of ducks of a certain type
There's a gang of elk and a singular of boars and a muster of peacocks strutting outdoors
There's a cete of badgers and a skein of geese, and a fall of woodcocks at sixpence apiece
There's a flight of swallows flying very high, and a host of sparrows are swiftly passing by
There's a dappling of sheldrakes and a watch of nightingales, and a rush of pollards with nice long tails

You should note that there are two names for geese, for they go by the collective title of gaggle when on the ground and by the name of skein when in flight

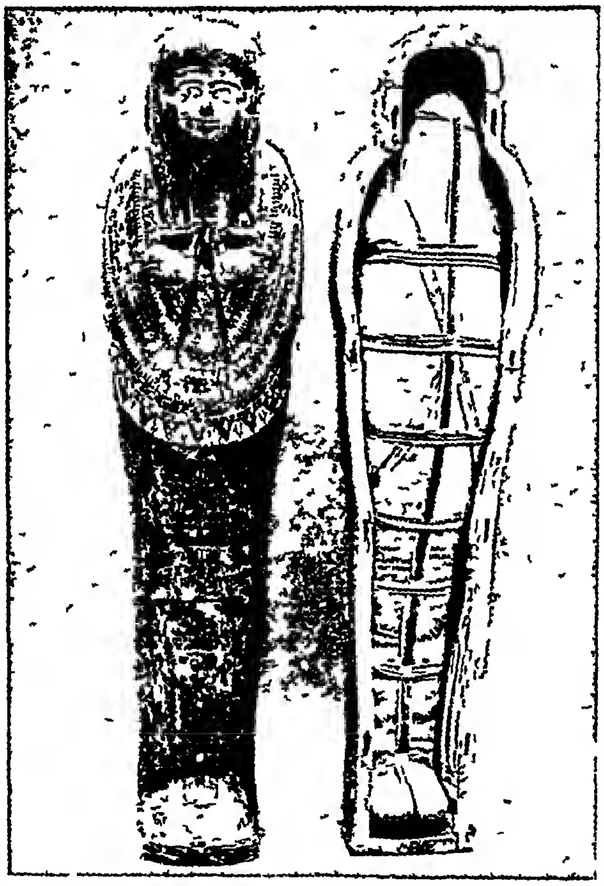
In the "Book of St Albans" (1486), Dame Juliana Berners tells us to speak of—a congregation of people (or plovers!), host of men, fellowship of women, bevy of ladies, herd of deer, swans, cranes, or wrens, siege of herons or bitterns, flight of doves or goshawks, clattering of choughs, skull of friars, pontificality of priests, superfluity of nuns, cast of hawks, mute of hounds, peep of chickens, and a blush of boys

Mummy. In the Egyptian rooms of the British Museum in London throngs of curious sightseers daily look into the very faces of the pharaohs and nobles of Egypt who ruled several thousand years ago Thousands of such mummies or embalmed bodies have been taken from the sands and tombs of Egypt, and thousands more may yet lie hidden, for the Egyptians practised the art of mummifying their dead for 3,000 years or more, believing that the soul would continue to exist in the world beyond the grave so long as the mummified body was preserved One of the oldest mummies found was discovered in 1937 by Mr Walter Emery The tomb from which it was taken dated back to 3,200 B C

The bodies were preserved by the use of bitumen, spices, gums, etc, or sometimes by immersion in honey, and after a seventy-day process were wrapped carefully in linen Then the shrouded mummy was usually placed in two cases of cedar, or of a sort of papier-mâché made to fit the corpse The inner case was plain, but the outer one was often covered with elaborate paintings and hieroglyphs telling of the life and various deeds of the deceased A moulded mask of the dead or his portrait on linen or wood sometimes decorated the head end of the case This double case was placed in an oblong coffin and deposited in a sarcophagus The bodies of the poor were merely dried with salt and wrapped with coarse cloths

Sacred animals—lions, dogs, crocodiles, birds, fishes, and even insects—were also mummified, and now and then whole shelves are unearthed, filled with embalmed cats who centuries ago probably caught mice round the temples of Egypt

The Egyptians excelled in this art of preserving the body in a life-like condition, but mummy-making was practised also in Peru and Mexico



WHEN A MUMMY CASE IS OPENED

This photograph shows a mummy case with the lid removed It contains the body of an unknown princess, whose image is modelled on the lid On the right the mummified body swathed in linen kept in place by bandages, is seen, fitting closely into the shaped coffin

British Museum

Munich, (Pron mū'-nik), GERMANY The "Athens on the Isar" is the name the people of Munich love to give to their city of palaces, museums, and parks, the capital of the former kingdom of Bavaria, situated on the river Isar

It is one of the best-built capitals in Europe Its rich art collections are its chief glory, and it is one of the leading cities of culture in the world

Most great cities owe their fame to advantage of position or to some fortunate accident of history, but the greatness of Munich (German, *Munchen*) to day is largely the result of one man's

deliberate policy Early in the 19th century King Ludwig I of Bavaria decided to make his capital one of the leading art centres of the world He succeeded in doing so at enormous cost, after years of planning and labour on the part of architects, sculptors, and collectors

The broad streets of the city today are lined with beautiful buildings copied from the world's most famous structures And in these buildings may be studied the art and industry of mankind since ancient times Bas-reliefs wrought by the Babylonians and Assyrians can be compared with the work of modern sculptors

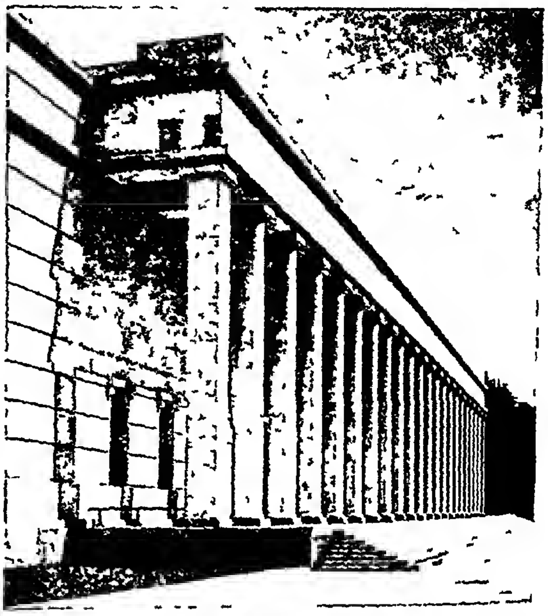
Famous Museums in Munich

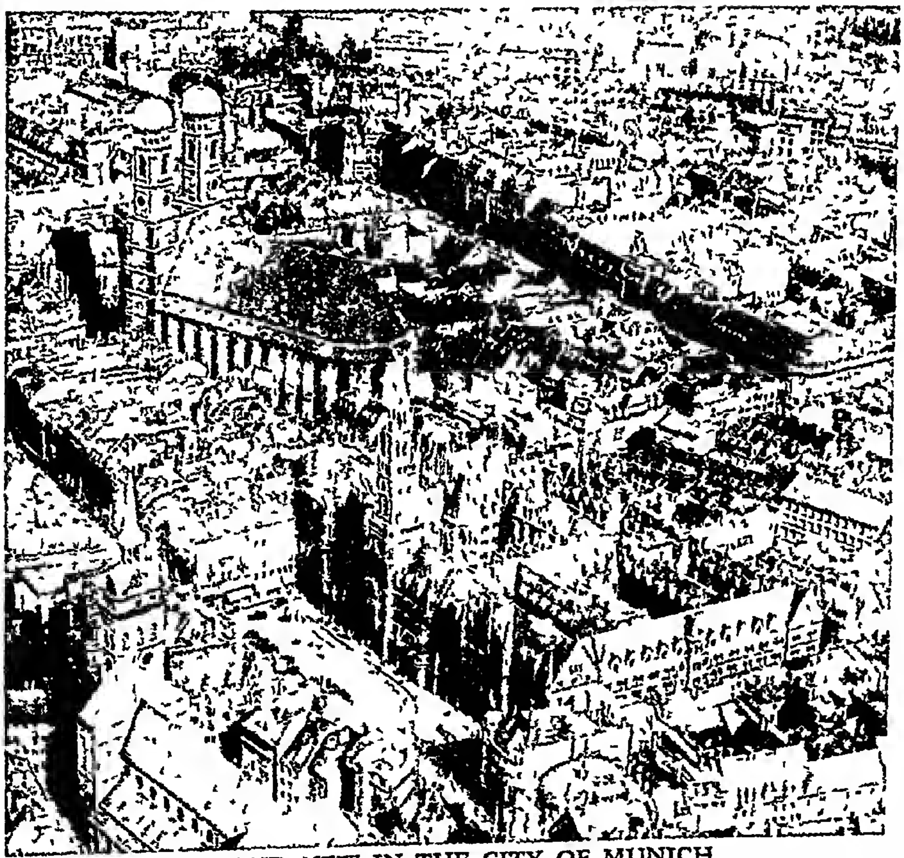
On the walls of one famous gallery (in the Old Pinakothek) hang the paintings of the old masters, and just opposite, in the New Pinakothek, are exhibited those of our own day Weapons, household utensils, and other articles from the Stone Age to the present time are arranged in chronological order in the Bavarian National Museum, the German Museum, designed to illustrate the growth of natural and technical science, is perhaps the finest science museum in the world

At the Bavarian National Theatre and the Residenz Theatre annual festival performances of Wagner and Mozart are given The National Library contains 30,000 rare manuscripts and 1,300,000 printed volumes The university, the academy of science, and the schools of music and painting attract many hundreds of students from all parts of the world Moreover, Munich is now the official headquarters of German (Nazi) Art, under the control of Field-Marshal Goering (*See* Germany, Painting)

But the presence of so much classic art and solid learning has not made Munich a solemn city Its people have long been renowned for their care-free gaiety, and during the carnival season just before Lent, the whole city comes to resemble a big playground

Munich is celebrated for artistic handicrafts, such as bronze-founding, glass-staining,





OLD AND NEW IN THE CITY OF MUNICH

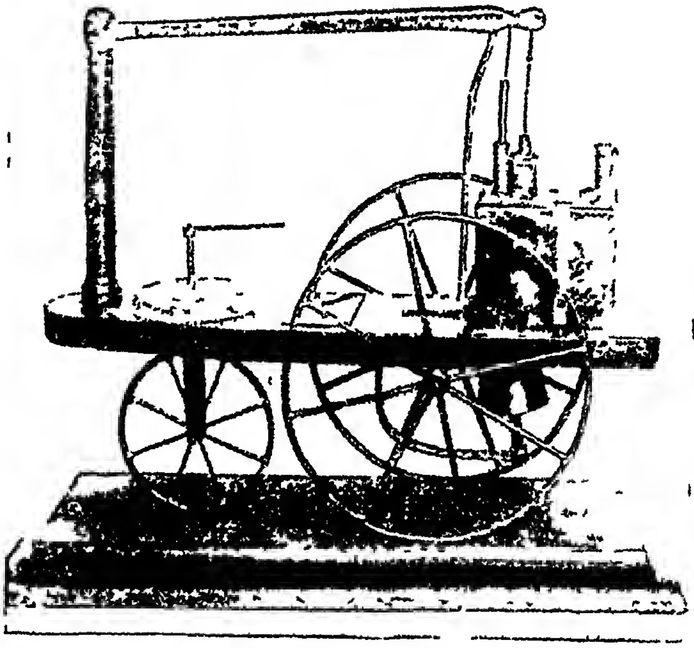
The lower photograph, taken from the air, shows the oldest part of the city of Munich The Gothic Rathaus, seen in the centre of the photograph, is, however, modern, having been completed in 1905 Above it to the left is the Cathedral, built in 1468-88, a Gothic pile with twin towers 318 feet high, crowned by wooden cupolas The top photograph shows the striking façade of the new House of German Art Munich is now recognized by the Government as the chief centre of all German culture

Courtesy of German Railways Information Bureau

silversmith's work, wood-carving, and lithography, the last having been invented in Bavaria in the 18th century Other industrial products are wall paper, railway machinery, gloves, and artificial flowers

The most important industry of Munich, however, is the brewing of beer The beer is of a superior quality, due not only to the excellence of Bavarian hops, but also to peculiarities of the water One brewery which makes a highly esteemed beer is said to get all its water from one spring

In the course of the revolution of 1918–19, which drove the Bavarian king from his throne and established the Bavarian republic, Munich was the scene of violent "Red" (Bolshevist) risings The headquarters of the Nazi movement is at the "Brown House" in Munich, and here Hitler made his first attempt (his *Putsch*) to seize power in 1923 There is a great memorial to the "Nazi martyrs" killed on that occasion Population, about 828,000



MURDOCK'S LOCOMOTIVE

Murdock's model steam carriage has been claimed to be the forerunner of the locomotive, but as it was intended to run on the roads it is more accurately described as an ancestor of the motor-car This photograph shows the original model with which he alarmed the vicar of the Cornish village of Redruth, by trying it out on the path leading to the church

Murdock, WILLIAM (1754–1839) In the year 1777 Matthew Boulton, James Watt's partner in the engine works at Soho, near Birmingham, was approached by a young Scotsman, who had walked all the way from Ayrshire in search of work When Boulton said there was no work to be had the lad was so disappointed that he dropped his hat Boulton was puzzled by the noise that the hat made, and, on questioning the young man, found out that it was made of wood, which he had turned on a lathe of his own making Impressed, Boulton gave the young man employment

The young man was William Murdock, one of the most industrious and ingenious mechanics that Britain has produced He was born near Old Cumnock, in Ayrshire

How He Scared the Vicar

The chief business of the Boulton and Watt firm was to supply pumping-engines to Cornish tin mines, and Murdock was soon sent to Cornwall to look after them He lived at Redruth, and while residing there he made a model "steam carriage," which is in a way the forerunner of the locomotive He tried it out one night on the road leading to the church, and the puffing apparition nearly scared the vicar of Redruth out of his wits But James Watt, Murdock's employer, could not see the possibilities of this method of transport, and at his request Murdock gave up experimenting

He was more successful in another direction, namely, in gas lighting His house in Redruth was the first to be lit by gas, and from 1803 part of the Soho foundry at Birmingham was regularly illuminated in this way When we think of the great benefits that gas-lighting and gas cooking have given to the world, we must all be grateful to William Murdock

For over fifty years Murdock served Boulton and Watt faithfully, and he was satisfied to let them have the full credit for his inventions, so that it is difficult to determine exactly how much he did invent There seems no reason to doubt that the well-known "sun and planet motion" on the steam-engine was contrived by him On one occasion he was fitting a steam-engine in the brewery of Messrs Barclay Perkins in Southwark, London He was asked if he could compare the power of the engine and of the horse it replaced, and after some consideration he worked out the formula for horse-power, which is still universally used On the same occasion the brewers explained to him the difficulty they had in clearing beer, and, after a visit to Billingsgate, he discovered that fish scales could be used for the purpose

Murdock was a great man in many ways, but without personal ambition, always more anxious to get things done than to receive reward or praise He died November 15, 1839, at the house he had built, within sight of the Soho foundry where he had worked so long

Murillo, BARTOLOMÉ ESTÉBAN (Pron mū-ril'-ō, Spanish moo rēl'-yō) (1617–1682) A young man of about twenty-five, footsore and exhausted from his 250-mile journey afoot across the Sierra Morena Mountains from

Seville, arrived in Madrid one evening about 300 years ago He was penniless, friendless, and very lonely and tired

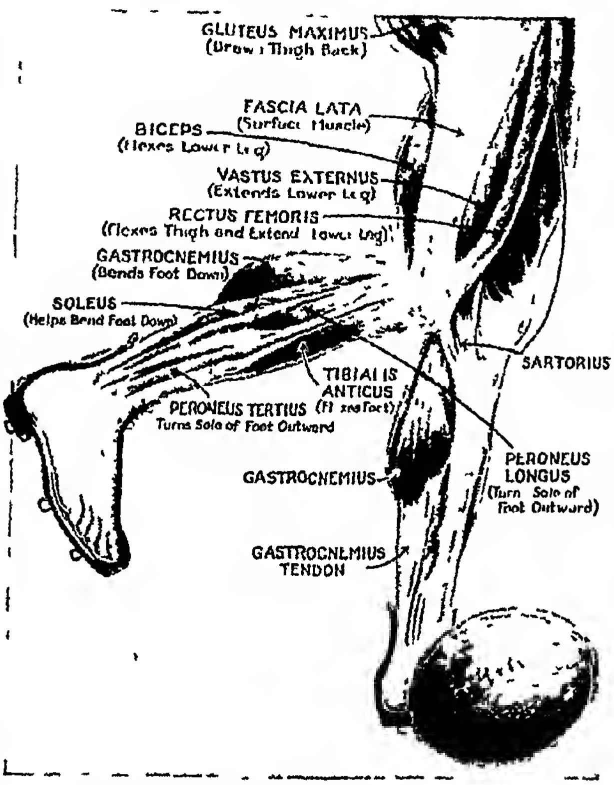
"Will you tell me where I can find Diego Velazquez, the court painter?" he asked a passer-by The other eyed him with indifference as he gave the directions—not knowing that he was speaking to the man destined to be Spain's most beloved painter and one of her few artists of world-wide fame

This was a red-letter day in the life of Murillo, the poor Seville mechanic's son, who, after a promising training, had for two years been earning a scanty living painting crude bright-coloured pictures which he sold in the market-place at Seville, and who had pluckily set forth to seek his fortune in the capital of Spain For on this same evening the great Velazquez, recognizing the talent of his ambitious young fellow-townsman, took the youth into his own home, and got permission for him to copy the art treasures in the royal galleries

Murillo progressed so rapidly that in less than three years Velazquez exhibited some of his work to the king and court He might now have looked forward to fame and prosperity in Madrid, but he preferred to return to his native Seville Soon he executed eleven large paintings for the Franciscan convent, which brought him immediate recognition After this he married a rich woman of rank, became the head of the Academy of Seville, which he helped to found in 1660, and lived happily, painting almost continuously, and principally religious works for the churches and convents of his beloved Seville, until a fall from a scaffold in 1681 brought injuries from which he died a year later

His body was buried in the church of Santa Cruz at Seville, and his generation mourned over the passing of their lovable, pious, popular, but unspoiled idol, their "angel painter born to paint the sky"

Among Murillo's most attractive pictures are many sympathetic realistic studies of the ragged urchins and flower girls whom he saw in the streets of his native city His later works are chiefly religious compositions, characterized by splendid colouring, great technical skill, and intense feeling, the few portraits he painted are of great beauty and speaking likenesses So realistic was his style that a spaniel in one of his pictures has been known to make a living dog snarl, and birds are said to peck at the lilies in his wonderful "Saint Anthony of Padua"—that beautiful picture of the kneeling saint stretching forth his arms to the Christ child



MUSCLES THAT 'WORK' OUR LEGS

This picture shows most of the muscles that are used in kicking, walking, and running The "Sartorius" is the so-called "tailor's muscle" which enables us to cross one leg over the other It is the longest muscle in the body

Murillo's greatest masterpiece is his "*Immaculate Conception*," or "Assumption of the Virgin" (*see* facing page), with the Virgin amid cherubs This painting, which now hangs in the Louvre, was brought from Spain during the Napoleonic wars and later sold to the French government for more than £24,000—at that time the greatest sum ever paid for a picture Murillo painted many another masterpiece, and although Saint Anthony and the Assumption of the Virgin, which he painted again and again, were his favourite subjects, many admire most his beautiful paintings for the Charity Hospital of Seville, among which are "Moses Striking the Rock," "St Elizabeth of Hungary Tending the Sick," and the well-known "St Peter Released from Prison"

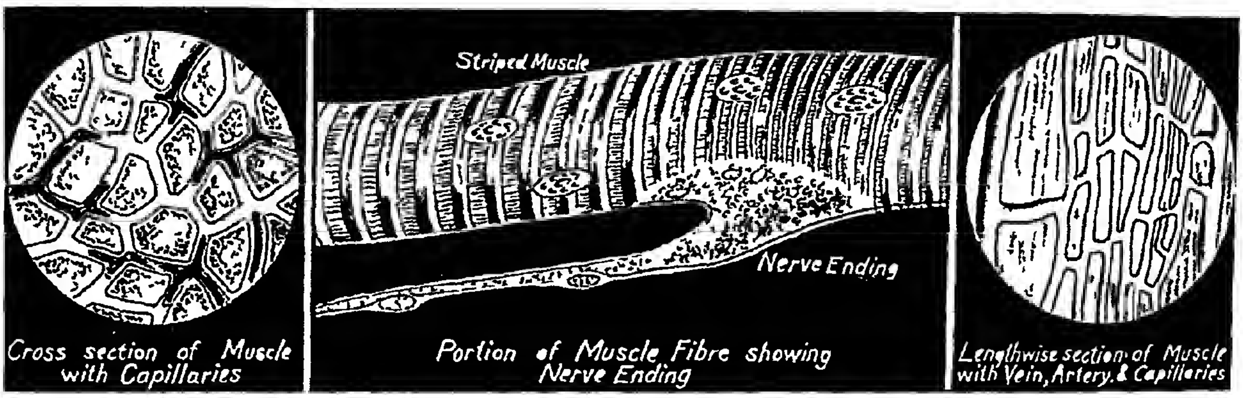
Though Murillo's work at times lacks force and originality, his love of colour and pious serenity and charm have made him one of the best loved of the world's painters

Muscles. The muscles are the workmen or the "movers" of the human body, for all movement, conscious or unconscious, is accomplished by them If we regulate the movement consciously we say the *voluntary* muscles did the work, if we cannot regulate it of our own free will we say the *involuntary* muscles performed it In certain diseases, e g St Vitus's Dance and tetanus, control is lost of certain of the voluntary muscles and spasmodic movements occur Muscle tissues have a peculiar power very highly

A FAMOUS MASTERPIECE FROM MURILLO'S BRUSH

Esteban Murillo, the Spanish peasant-boy who became one of his country's greatest painters, was especially famous for religious pictures. In this painting of the Virgin Mary with a company of cherubs, his tenderness and sincerity are seen at their best

The Louvre Paris



WHAT MUSCLES LOOK LIKE WHEN SEEN THROUGH THE MICROSCOPE

Here we see how muscles are controlled and fed In the centre is a single fibre Its striped formation enables it to contract or expand whenever the nerve sends in its " orders " At the left is a bundle of fibres, cut across to show how they fit together The capillary blood-vessels contain the blood which nourishes them The picture on the right shows how the capillaries connect the arteries and veins

developed , this is the power of contracting and relaxing like a rubber band

The largest muscles are those of the arms, legs, shoulders, and back They are fastened by tendons to the bones, and the sort of work they do can best be observed by studying your own arm The biceps muscle on the front part of the upper arm is fastened by one end to the shoulder , the other end is attached to the main bone of the forearm just below the elbow Now bend your arm at a right angle, making the muscle rigid You can feel the hard, thin cord of the tendon right at the crook of the elbow

At the same time, the top muscle of the forearm runs back to the outside of the upper arm, the two crossing each other over the elbow You can push the tip of your finger between them at that spot These muscles are simply using the bones of the arm as rigid levers to do their work

When the forearm is thrust sharply downward, as in chopping with a hatchet, it is being pulled by the triceps muscle, which runs along the back of the upper arm and round the outside angle of the elbow

All the muscles which are fastened to the arms and legs are voluntary muscles They consist of bundles of fibres, each about an inch long and $\frac{1}{500}$ of an inch wide These bundles of fibres are enclosed in elastic skins, which hold them together and protect them The muscles attached to the ribs of the chest share with the diaphragm muscle the work of expanding and contracting the lungs in breathing (*See* Diaphragm) These are voluntary muscles, although they continue to work through force of habit, even when we are asleep

ONE OF THE MUSES
Calliope, shown in this statue, was the Muse of epic poetry, and was represented with wax tablets and a stylus, or writing instrument
Vatican Museum Rome

The heart and the muscles of the stomach and intestines and other internal organs cannot be controlled at will They continue to work whether we wish it or not, and for this reason are true involuntary muscles The muscles which cover the outside of the abdomen directly under the skin must not be confused with the stomach or intestinal muscles (*See* Heart , Stomach)

There are altogether 500 muscles in the human body They form the " lean " flesh, and constitute fully half of a person's weight Muscles develop and become strong with use, or get weak and flabby through disuse Exercises to train the muscles and keep them active are, therefore, the only sure road to health and strength

Cramp in the arm or leg is due to a sudden and involuntary contraction of a muscle which is ordinarily under control This is usually caused by some disorder of the nerves leading from the brain Contributory causes may be prolonged exposure to cold, or a tendency to gout or rheumatism

Muses. Sometimes we say that " we have an inspiration " It seems almost as though some power outside ourselves made it possible for us to think, or speak, or write, or do something better than usual The ancient Greeks believed that this inspiration came from the Muses, goddesses who presided over the arts and sciences So poets and musicians began their important works with a prayer to one or more of the Muses

Though the number varies in different accounts, these divinities were generally pictured as nine maidens, the daughters of Zeus, king of the gods, and Mnemosyne (Memory) When the gods gathered together in festive assembly on

Mount Olympus, the Muses were always present to furnish inspiration and entertainment Led by Apollo, they sang of the origin of the world of gods and heroes, and celebrated the glorious deeds of Zeus On earth many places were sacred to them, especially on Mounts Parnassus and Helicon The word "museum" in its Greek form originally meant a temple sacred to the Muses

Calliope, the most honoured of the Muses, presided over epic or heroic poetry Clio was the Muse of history, Euterpe of lyric poetry, Thalia of comedy and pastoral poetry, Melpomene of tragedy, Terpsichore of choral song and dance, Erato of love poetry and Polyhymnia of hymns Finally, Urania was the Muse of astronomy

Museums. Again and again, in the pages of this or any other book of reference, you will find references to museums of various kinds, not merely local museums mentioned in the descriptions of towns and cities, but also the more important national museums in which each country of the world houses its treasures The scope of these museums is as wide as you can imagine Some include every conceivable type of object that may be found in a country, or outside it, from natural history to relics of great men and works of art, others are more or less confined to one type of object, or even within narrower limits, others, again, show only materials gathered from one definite district, and others may be confined to relics or works of one man or one period

Museums of art are in general known as galleries (*see* National Gallery), especially where pictures make up the bulk of their objects There are many art galleries of this type in London, and we also have one great museum of art, taking the word in a wide sense, in the Victoria and Albert Museum, at South Kensington This is probably the world's finest general collection of *objets d'art* Besides a number of pictures—especially water colours of the British school—it contains furniture and woodwork, pottery, dresses, and costume, sculpture, carpets, goldsmiths' and silversmiths' work and indeed everything of this type that you can think of It has, like most of the largest museums, a fine library

Our greatest museum, of course, is the British Museum, whose huge building is in Bloomsbury This is largely a museum of antiquity, and its contents cover an enormous period, its collections of Greek and Egyptian material are specially famous It was founded in 1753 Besides the galleries in which the museum's treasures are shown to the public, there is at Bloomsbury the largest and most comprehensive

IN THE NATURAL HISTORY MUSEUM

The Natural History Branch of the British Museum is situated at South Kensington, and contains the most complete collection of specimens in the world It is housed in a fine building of terracotta which was completed in 1880 The photograph shows the entrance hall, in which there are many interesting exhibits

Courtesy of the British Museum (Natural History)

library in the world, and a magnificent collection of prints and drawings

London's museums of Science are numerous The chief are those grouped at South Kensington, comprising the Natural History Museum, the Science Museum, and the new Museum of Practical Geology Each of these represents a series of superb collections, and all of them are continually receiving additions The Natural History Museum in particular shows only a small proportion of its treasures in its galleries, and indeed it is famous abroad as a storehouse rather than as a museum for display In the Science Museum you may see many of the original inventions that have gone to make up our modern world, from the early steam-engines of James Watt to the racing seaplane that won for Britain the last Schneider Trophy , there is also a fine collection of ship models

In London, too, there are innumerable special museums The London Museum, for instance, contains collections illustrating the city's history, as also does that of the Guildhall In the Geffrye Museum is housed a fine collection illustrating the history of the furniture trade , while the Horniman Museum in South London deals with anthropology and natural history

At Greenwich is a fine Maritime Museum, while the Imperial War Museum is at Lambeth And all over the provinces there are others Most counties have their own museums, situated in the county town and dealing in a general way with the history, natural history, and antiquities of the county There are, too, many museums dealing with famous men, most of them situated in their former homes and containing collections of their relics An example of this is Down House, at Downe, in Kent, where Charles Darwin lived, and where rooms are arranged just as they were in his lifetime (*See* p 1229)

On the Continent, Paris has the Louvre, the world's largest collection of art treasures (*see* p. 2579) , Germany has many fine museums , and Italy, Austria, and Spain have also famous art museums On the whole, however these contain art treasures, and we must go to America to find general museums comparable with those of England There, the New York Metropolitan Museum of Art has an extremely fine collection, more or less comparable in scope with that of the Victoria and Albert , and most of America's great cities have fine collections of a similar nature World-famous, too, is the American Museum of Natural History, in which are displayed superb " habitat groups," showing collections of creatures in their natural environment (*See* plate fac p 1663 and illus p 1900) Groups of this type are a feature of other American Nature museums, such as the Field Museum, Chicago (*See* plates fac pp 80-81) In America, museums are considered far more important, educationally, than they are in England, and their arrangement is largely governed by this consideration

Mushrooms. Mushrooms and toadstools provide the material for many of the favourite fairy stories of childhood, yet the mushroom itself is scarcely less romantic and interesting than any tale of fairy lore What could be more wonderful than a plant that has no root, no stem, no leaves, and which springs up with such rapidity that you can see it grow, living purely on the food provided by animals and other plants ? And how varied their shapes and colours—flat and umbrella-like or branching like corals, and delicately tinted with reds and greens and browns !

But perhaps the fact about mushrooms that should most interest us is that while some of

MUSHROOMS, LARGE AND SMALL

The picture to the left shows a cluster of true mushrooms, those fungi which make such delicious eating They are common but never reach such a size as the giant puff-balls, like the one the lady in the lower picture is comparing with a mushroom This great fungus was 43 inches round and weighed some five pounds !

Photos top E Step bottom Fox Photos

MUSHROOMS GROWN FOR MARKET

We always think that the nicest tasting mushrooms are those we have picked ourselves in the dewy fields on a summer's morning, but the market is mainly supplied by specialized mushroom-growing farms The fungi are raised, as is seen here, on banks of soil, carefully protected by straw and tarpaulins until the time comes to pick them Then the coverings are thrown back and the tasty mushrooms that have sprung up in the dark are picked, packed, and rushed to market

them are delicious food, others contain a poison so powerful that to eat it is almost certain death Hundreds of persons die every year from mistaking the poisonous for the edible varieties

You frequently hear people refer to poisonous mushrooms as "toadstools," and often the two words are completely confused But the botanist calls mushrooms those fungi of the group *Basidiomycetes* which have a conspicuous fruiting body, including the round and umbrella-shaped kinds as well as the large fleshy forms The common idea that all mushrooms with umbrella-shaped caps are poisonous is not correct Many of our mushrooms are edible, but we must be very careful when we gather them because it is so easy to make a mistake

Parts of a Mushroom

Let us see first what mushrooms are and how they grow, and then examine some of the common edible and poisonous varieties The part of the mushroom plant which rises above the ground is only the fruiting body of the fungus, the rest lying under the ground or in a rotting log in the form of a mass of dense white tangled threads, called the *hyphae*, and forming a *mycelium*, which constitutes the "spawn" The mycelium grows from little spores shed from the full-grown mushroom From it bud out small whitish knobs of tissue, which push upward, expand, and finally break out in the particular form for each kind of mushroom

On most mushrooms you will find underneath the umbrella little radiating plate like gills, set very closely together It is on these gills that are developed the tiny spores, which drop out, and are carried far and wide by the wind These develop new plants when they fall upon favourable surfaces (*See* Fungi)

Most mushrooms delight to grow in moist shady woodlands, or in the bottoms of ravines where there is an abundance of shade and plenty of warmth and dampness The common field mushroom and a few others are exceptions to this rule, for they grow best in open grassy meadows, fully exposed to the sun

Mushrooms spring up with amazing rapidity during warm, muggy summer nights, and reach their full growth, shed their spores, and decay in a very short time They are strong enough to push up heavy paving stones as they grow!

We are all familiar with the common field mushroom It is a rather stocky, solid form, white with pinkish-brown gills It grows most abundantly in pastures, and is also largely cultivated in specially prepared beds Enormous quantities are raised in Paris in underground galleries which extend for many miles at a depth of 60 to 160 feet below the surface, and in recent years mushroom growing has become profitable in England, too

After the field mushroom, the most common edible forms are the *puff balls* These are large, round, whitish knobs, often seen growing along streams and roads and also in open pastures They are filled with a soft, white, firm flesh, which turns into a mass of fibres and dark

brown spores when the plant is ripe. Have you ever stamped on a ripe puff-ball and watched the clouds of tiny spores rise from it like smoke? All the puff-balls are edible when young, but you must be careful to gather them only when they are large, as some poisonous forms of umbrella-like mushrooms pass through a ball-like stage when young. Though all the puff-balls are edible, not all are pleasant to the taste. The black puff-ball, which is hard like a potato and whose flesh is a glistening black, is very bitter, though not harmful.

Another group of edible fungi is the clavarias, or coral fungi. These grow up in finger-like masses in pretty hues of delicate pink, white, and yellow. The white varieties are the best for food. The clavarias grow only in deep, dark, damp woodlands, and wilt very easily when brought out into the sun. They look just like beautiful bunches of coral shining out among the dark forest trees.

The morel, which is one of the choicest of the fungi (though it is not a true mushroom and belongs to the *Ascomycetes* group), is easily recognized by its pale yellow, buff, or light green conical cap, ribbed and pitted like a honeycomb, and set on a stout whitish stem. In the same group is the delicious truffle, a fleshy tuber-like fungus which is found in many parts of Europe, and grows in groups a foot or so below the soil. Dogs and pigs are very fond of truffles, which they dig for with great skill, and in France they are trained to search for them by scent.

Another prized mushroom is the chantarelle, distinguishable by the deep rich yellow of its cap, which has an irregular crumpled margin. Its odour suggests ripe apricots or plums. The cap is usually depressed at the centre.

These You Must *Never* Eat

Let us turn now to examine some of the poisonous kinds. Two very deadly species are the death cap (*Amanita phalloides*) and the fly agaric (*A. muscaria*), both common in the British Isles. The former has a white stem round which is a neat ring of tissue, while the cap has a yellowish top. It is our most dangerous species owing to a superficial resemblance to a true "mushroom."

In the fly agaric, the top of the cap is a brilliant red, flecked all over with tiny white shining scales, like snowflakes, while the rest of the plant is pure white. This species is often found growing under birch trees. It gets its name from the fact that its poison, extracted by steeping in milk, was used to kill flies. The poisonous substance in the amanitas and many other kinds of fungi is known as "muscarine."

There are several other kinds of poisonous mushrooms. It is a wise rule not to eat any except those of which you are absolutely sure, and these only when they are perfectly fresh. Only one-tenth by weight of a mushroom has any food value.

The ANCIENT ART *of* ORPHEUS

From the earliest times music has been one of the best-loved arts practised by Man, and today, when it is broadcast by wireless, it is more widely appreciated than ever before

Music. It has well been said that "Music washes away from the soul the dust of everyday life." The story of music begins with the story of the human family. Some of the very oldest fables that we have tell us of the power of music. We know that before ever musical instruments were made there must have been chants or songs. And yet, from the days when men heard answering voices in the hills and caverns, there are legends that tell of instruments so sweet that their music charmed both men and the beasts.

oth-century Harp and Horns

One story is that the ancient Greek hero Orpheus charmed not only the beasts but the very trees and stones with the music of his lyre, and a Chinese musician, who is supposed to have lived a thousand years before Orpheus, said: "When I play upon my *kin* the animals range themselves before me spell-bound with melody." Music is what we call an "abstract" art. It is seldom "about" anything. You cannot really describe things in music, or explain music in a definite way. But music can make a listener *feel*, and so the earliest music was undoubtedly singing—words and shouting jumbled together—the spontaneous expression of emotion. Rhythm was the first element to develop, as you can tell from its connexion with dancing. African natives today can beat out extraordinarily complicated rhythms, some of which have passed into our modern dance music (*see* Jazz).

We read in the first chapters of the Bible that Jubal was the "father of all those that handle the harp and the organ." In the temple of King Solomon, which was built almost a

ORPHEUS CHARMING THE BEASTS OF THE WILD WITH HIS LYRE

The lyre was the chief musical instrument of the ancient Greeks, and with it they accompanied their songs and recitations It figures in Greek mythology, for Orpheus, son of the muse Calliope, was famed for his extraordinary skill with the lyre given to him by Apollo Such exquisite music did he produce that even wild beasts were charmed by it After he had finally lost his wife, Eurydice, he wandered into the forest and played to the animals who strove in their dumb way to comfort him In this picture J M Swan, R A, has depicted the old myth of Orpheus in the forest playing to lions and lionesses

thousand years before the birth of Christ, we are told that there were thousands of priests, with trumpets and harps and psalteries, and that there were singers who sang beside the altar to the harps and other instruments

The Psalms of the Bible are the words of Hebrew songs How we should like to hear the tunes to which those words were sung! When you have been reading a Psalm, have you ever wondered what was meant by the word *selah*? Historians tell us the Psalms were sung by two great choirs, one on either side of the temple One choir sang the first line, and then the other choir answered with the next line, in this manner

First Choir The earth is the Lord's and the fullness thereof

Second Choir The world and they that dwell therein

First Choir For he hath founded it upon the seas

Second Choir And established it upon the floods

And so they continued through the Psalm until the word *selah* occurred, then the singers paused and the instruments played an interlude alone, after which the singing was resumed Where there was only one choir, the opening and alternating lines were given by the priest, and the choir responded This method of singing is still used occasionally, and is known as "antiphonal" singing

The Greeks were the first people to leave any sort of written music, and what they left was very crude They used the letters of their alphabet to represent musical tones These they placed above the words of the poems which they sang But this only served to give, in a very poor way, the pitch of the tone, and in no manner expressed the length of time during which it was sounded The Greeks had music in their theatres, just as the Hebrews had in their temples But naturally the music was different They used both wind and stringed instruments, and there are pictures which show the chorus dancing and playing their instruments as they sang

Music as we know it began with the Christian era, though we really have very little knowledge of it during the first 400 years of this period It was about the year A D 350 that the first singing schools were established, for the purpose of training singers for the Church services In ancient times the congregation sang with the choirs, but the singing came to be so badly done that the council of Laodicea, in the year A D 367, decided to allow only trained singers to take part The songs they sang would sound very strange to our ears, for all

sang the same melody in unison There was no alto, or bass, or tenor More than this, the songs were mostly chants, which means that several words were sung, half spoken, to one tone A step in advance was taken by Pope Gregory the Great (c 540-604), who revised the music of the Church services and introduced what is still called the "Gregorian Chant" All chants or songs had to be learnt by heart, because even then there was no satisfactory way invented to write music

At last, a young monk named Guido, of Arezzo, Italy, became much dissatisfied with this slow process In a letter written in A D 1020 he complained "When little boys have finally learned to read the psalter, they can read all other books Whoever has once trimmed a vine or tree will be able to do it again as well or even better These wonderful singing teachers, however, and their scholars may sing every day for a hundred years, and yet not be able to sing the response without instruction In the Church service it often sounds, not as if we were praising God, but rather as if we were engaged in quarrelling among ourselves"

But this young monk not only complained, he at once set out to remedy the trouble, with such success that he has been called the "father of music" He used the musical staff, much as we have it now, and also our system of singing by syllables The idea came to Guido in this way A certain Latin hymn, whose first six lines began respectively on the first six tones of the scale, suggested to him that if the pupils learned this song and remembered how to pitch the first tone of each line, they would then know the pitch of that tone wherever they saw it The lines began with Latin words, the first syllables of which were *Ut* (afterwards changed to *Do*), *Re*, *Mi*, *Fa*, *Sol*, *La* The fact that *sol-fa* singing, with these same syllables, is still in use today proves the soundness of his theory Of course, this idea would not have worked had the staff not already been invented on which to write the syllables The next step was to invent some way of showing the relative length of the tones Gradually block notes of different shapes were worked out with a dot or a hook to mark the accented note

LEARNING TO WRITE MUSIC

It took men thousands of years to learn to write music in the simple and intelligible modern fashion As early as the 6th century of our era musicians had begun to indicate musical sounds by a complicated system of dashes, curves, hooks, and dots, as you see in the example at the top By the 12th century they had introduced a four-line staff with square notes, thus indicating the intervals between the sounds From the 15th to the 17th century square and lozenge-shaped notes with or without "tails" to indicate time values were used, with a five-line staff and key signatures, as in the third and fourth examples From this it was a short step to the present system, with time divisions shown by bars at right angles to the staff

At first all music was sung in triple or three pulse time, with one strong and two weak beats to each group Later double time, with one strong and one weak beat to each group, was used Then bar lines were drawn across the staff before each strong or accented note The notes were also made round instead of square, and written music began to look as we see it now

Two staves were used, one for higher voices and another for lower voices, with a note for a short cross line (now called "middle C") in the position where one line normally would stand between the two staves This made the remaining notes of the octaves, written up and down, come in different places on their respective staves The *treble clef* is used to mark the upper staff, and the *bass clef* marks the lower one Notes above or below these staves are placed on or between short lines called "leger lines" prolonging the staff

The scale resulting from playing all the notes on a staff so constructed is the scale of C major Since two of the intervals in any scale are half steps or semi-tones, if one desires to write the scale for any other key there must be some device for raising or lowering the pitch indicated by any given note Such devices are called chromatic symbols These are the sharp (♯), indicating the half-tone above the written note, the flat (♭), marking the half-tone below the one written, the double sharp (x), meaning one *whole* tone above, and the double flat (♭♭), meaning one whole tone below the one written

To avoid having to use these symbols as long as the key is played, it is customary to place the

symbols just before the beginning of the music on the staff Every note so marked is then to be raised or lowered whenever it occurs Since certain effects require that this be *not* done, this is indicated by placing a " cancel " mark (♮) before a note to show that it has its " natural " or unmarked staff value

Sometimes the composer wants to have a gap, or blank spot, in his march of accents To make this unmistakable, the composer marks it with a rest, of a shape signifying its duration

To indicate the accent-pattern intended, a time signature " is given at the beginning of the music The signature for waltz time, for example, is $\frac{3}{4}$ The 3 indicates three accents to the measure, while the 4 in the denominator means that one quarter-note is used for each accent In foxtrot ($\frac{4}{4}$) time, the numerator 4 indicates four accents to the measure, each one a quarter-note in duration

Although the music of the Church was now set down in writing, there was still much valuable music of which we have no written record The common folk had their own songs and dances, and bards and minstrels wandered from court to court, always welcome because of the music they made

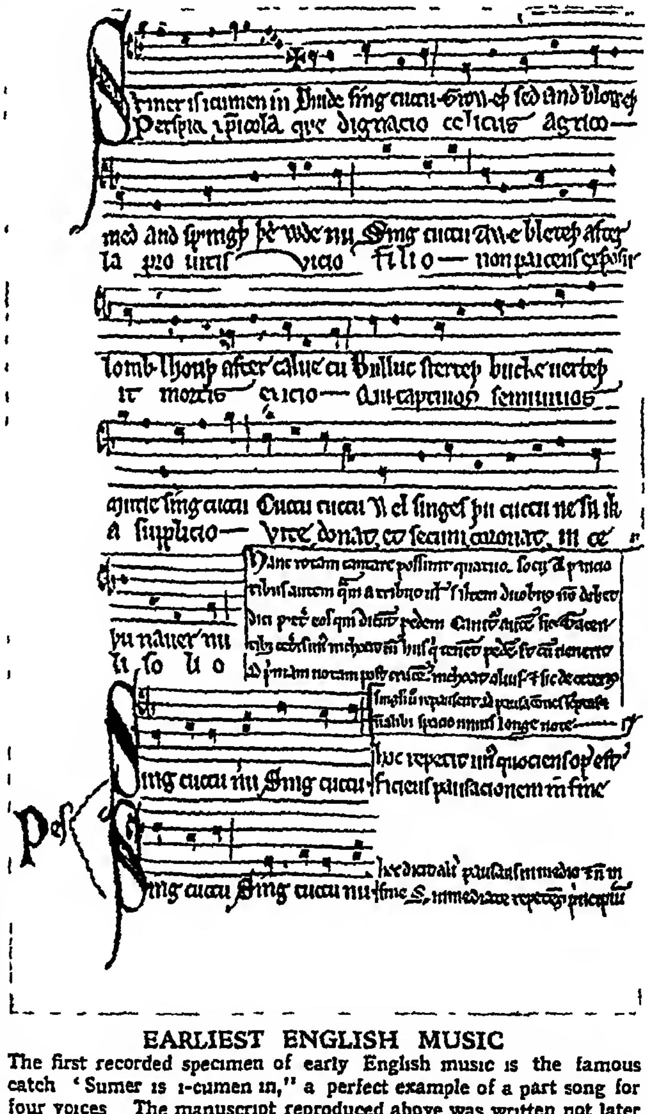
Even during war the bards were welcome in enemy camps, so esteemed was the art of minstrelsy There is a well-known story telling how King Alfred the Great disguised himself as a minstrel and entered the camp of the Danes as a spy on the eve of a great battle What, we wonder, did he sing ? Very few of the old folksongs of this far off time have come to us, and these are so changed, from having been passed down for generations, that we can hardly consider them representative in their present form

About the 12th century secular music —that is, music that is not religious— began to be very popular In southern France, the troubadours composed and sang songs of their lady-loves, in Germany, the minnesingers composed similar songs as well as songs of chivalry, patriotism, and Nature, which they sang to the accompaniment of the harp Other German singers formed themselves into a guild called the "master singers" (*die Meistersinger*) In this guild, rewards were given for excellence in musical composition submitted at an annual contest In Wales, an organization of singers known as the Eisteddfod (*q v*), or congress of bards, dating back long before the Christian era, assumed its present form during the 4th century, and continues to the present day In these ways both vocal and instrumental music were stimulated Many new instruments were used, and old ones improved

Music is made up of three elements—melody, rhythm, and harmony Up to this time only two elements, melody and rhythm, had been developed Another hundred years passed before the third element, harmony, was added

For many centuries all singing had been in unison or in octaves, and it was an important step in advance when two or more independent parts, or " voices," were used at the same time No one has learned when this began, but we have specimens of part-writing which date as far back as the 9th century This music sounds strange to us, for it used successions of " fourths," such as C-F (sounded together) followed by D-G, or " fifths," such as C-G followed by D A , whereas today our ears are accustomed to " thirds," such as C-E followed by D-F In time part-writing developed

The third element in music was at first called " counterpoint " This name was given because the notes of the melody written on the staff were



EARLIEST ENGLISH MUSIC

The first recorded specimen of early English music is the famous catch 'Sumer is i-cumen in," a perfect example of a part song for four voices The manuscript reproduced above was written not later than 1240, and, as a concession to religious feeling, had the words of a hymn in Latin written beneath the English verse

British Museum Harleian MS

A MINSTREL WITH HIS LUTE

The lute, a pear-shaped stringed instrument built up of staves of wood, and somewhat resembling a mandolin, came originally from the East. In the 16th and 17th centuries many varieties existed in Europe, and the lute was the favourite instrument for accompanying songs. This painting by the Dutch artist, Judith Leyster, shows a 17th-century lute-player

Photo Mansell

were employed for secular music in what were called "madrigals." These are part-songs with lively dancing rhythms and emphatically developed individual melodies for each voice. In Henry VIII's and Queen Elizabeth's reigns England was full of madrigals. If you went out to dinner, you were expected to sing your part at sight in a madrigal.

Every gentleman was supposed to be able to play the lute (a mandolin-like instrument), and the favourite instrument for ladies was the virginal, or small harpsichord, on which Good Queen Bess herself was a skilled performer. Several other instruments of the keyboard type also came into popular use. These were used at first, singly or in combination, to accompany singers. Composers then saw their possibilities and began to write for them alone.

In the so-called Flemish school of composers (1400 to 1600) music abroad reached a higher point than it had ever before attained. The "Venetian School" of musicians (1527–1612) saw that the different voices in "counterpoint" really combined to form a succession of chords, and launched the idea we find running through modern music—that of chords enriching the principal melody and also carrying subordinate melodies.

With these new developments, musicians of the Catholic Church began to create really beautiful music for their formal services. The mass was a favourite form of composition. One outstanding name in this connexion is that of the Italian composer Palestrina (c 1525–1594). He was a peasant by birth and was educated at Rome under a teacher from the famous Flemish school of music. He not only became the greatest organist of his time, but wrote masses which are as yet unsurpassed. It was of one of his masses that Pope Marcellus II said: "These are the harmonies of the 'new song' which the Apostle John heard out of the heavenly Jerusalem." Along with the music of the Catholic Church, the music of the Reformed, or Protestant, Church developed. Luther wrote many beautiful hymns.

With these new interests in vocal music, instrumental music had become very popular. The organs were so improved that the greatest musicians of the time composed for them. Other instruments with keyboards were invented (*see* Musical Instruments), and these greatly helped the musicians who were just beginning to put two and three tones together into what we call chords, and so to develop harmony as we know it today. The violin was

called "points", and now, in addition to these points, a second melody of points was written, point for point, for the two melodies were to be sung at the same time. As the choirs became able to master the two-voiced songs, third, fourth, and fifth melodies were added, giving rise to what is called the polyphonic ("many-voiced") form.

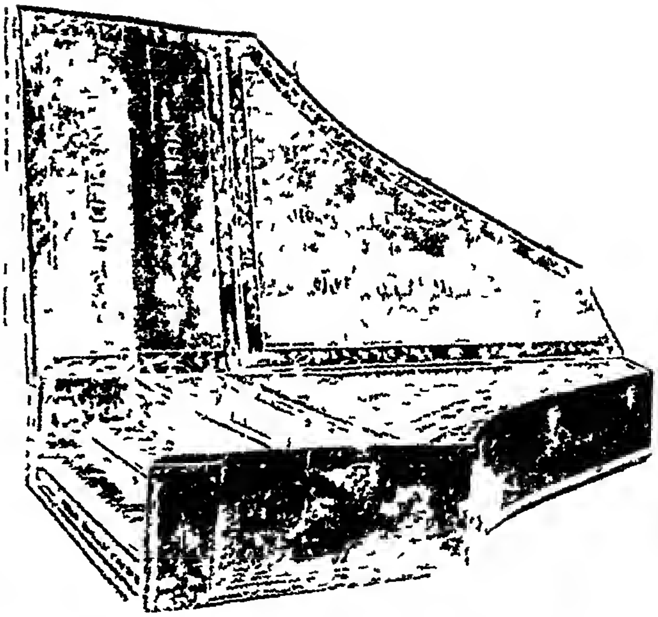
The earliest surviving example of secular part-writing, "Sumer is icumen in" (Summer is a-coming in), is believed to have been written as early as 1240 by an English monk, John of Fornsete. This is called a "canon" or "round," a type of composition in which each part has exactly the same tune, but enters separately, delayed perhaps by one phrase or two, as in the French children's song, "Frere Jacques." It also has a definite "ground bass," that is, a set part or figure, which is repeated all through the piece and is not a real tune in itself. Presently the methods of polyphonic writing developed for Church use

perfected about this time, and violin solos were greatly in demand An instrumental solo was called a "sonata" (sound piece) to distinguish it from vocal music, which was called a "cantata" (singing piece) And, most important of all, about this time (the year 1500) movable types that could be used for printing music were invented

What is spoken of as modern music began shortly before the year 1600 About that time the first opera was given in Florence, and the first oratorio in Rome (*See* Opera) The orchestra (*q v*), in something like its modern form, was also developed a few years later

During the next two hundred years music developed very rapidly, and to this period belong some of the greatest masters of the art the world has ever known Johann Sebastian Bach, who lived during this time, lives again in the concert programmes of today George Frederick Handel, whose "Messiah" is a part of our yearly Christmas festival, belongs to those years, as do also Haydn, Gluck, and the delightful Mozart During this time, too, the piano was invented and the orchestra became popular

The great masters of this period established the chief musical forms as we know them today

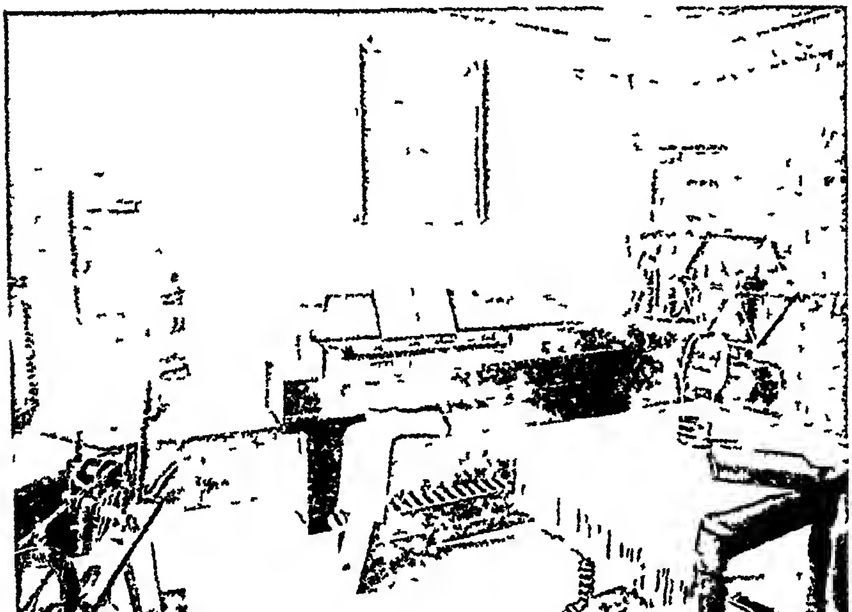


HARPSICHORD USED BY HANDEL

Before the invention of the pianoforte the most important of stringed instruments with a keyboard was the harpsichord This photograph shows the harpsichord on which Handel played It is now in the Victoria and Albert Museum, London

The "suite" was a name given to a set of old-time dances, as a musical form it came to mean a group of movements in the same key and for the most part maintaining dance rhythms These dances were particularly popular in France, at the court of Louis XIV, whose court musician, Lully, rose from being a scullion to the post of ballet- and music-master to the royal family Also connected with the music-loving French court at this time were the more serious composers, Rameau and Couperin (*See* Ballet)

The sonata was particularly the work of Haydn It usually has three or four movements, or divisions, all obeying certain rules The first movement is invariably an *allegro*, or lively movement, containing an "exposition" or statement of the subjects, a "development" or working out of the subjects, and a "recapitulation" The second movement is usually an *adagio*, *largo*, *andante* or other slow movement



IN BACH'S BOYHOOD HOME

Johann Sebastian Bach, perhaps the greatest of German composers, was born at Eisenach in Germany on March 21, 1685, and lived there until his parents died when he was 10 years of age His birthplace is now a museum, in which there are many relics of the composer In the sitting-room, above, is the clavichord used by Bach, and, over it, a portrait of his father

Next comes a lighter movement—a *minuet* or *scherzo*—followed by a quick *finale*, often in *rondo* form The term "sonata" is restricted to a composition for one or two instruments The *concerto* is an enlarged sonata for a solo instrument and the orchestra, the *symphony* is a sonata on a grand scale for an orchestra These developments owe their origins to Chamber Music Many people consider this a very dull kind of music, but it is most important, since the quartet, trio, sonata, and similar works for small combinations of instruments suitable for performance in a rich man's "chamber" or "salon," contain the "bare necessities" of all music, and are rightly called "musicians' music"

In Europe, the 19th century gave to the world the two men whose names stand for the highest development of instrumental and dramatic music The sonatas and symphonies of Beethoven are as yet unsurpassed Only Brahms, the German-Viennese composer who used Hungarian folk-tunes daringly in his symphonies, could approach him in the later 19th century

An entirely new development was the colossal "music drama," something on an even larger scale than "grand opera" itself, of Wagner, who so expanded the dramatic and harmonic resources of music that his influence may be traced in the work of most composers since his time The 19th century is also remarkable for the development of the lyric to a finished art-form in the hands of such composers as Schumann and Schubert The last great song-writer of this era, the master of the *lied*, was Hugo Wolf (d 1903)

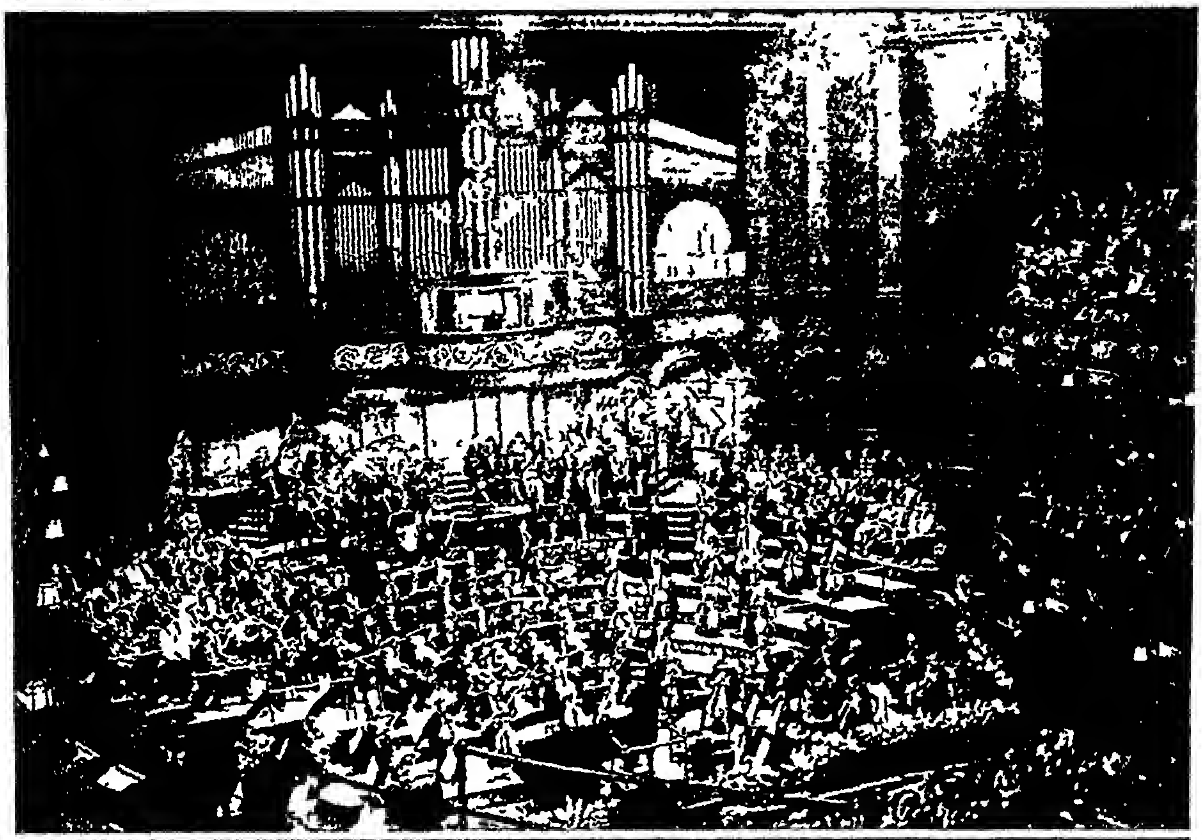
The closing years of the century were marked by a development towards greater freedom of expression and increased complexity of structure, which still remain as the outstanding characteristic of present-day music This is seen at its fullest in the work of such men as Debussy in France, Richard Strauss in Germany, Edvard Grieg in Norway, and Tchaikovsky in Russia Later composers whose work reveals new ideals and methods are the Russians, Stravinsky and Scriabin, Schonberg and Alban Berg in Austria, Bela Bartok in Hungary, Ravel and Milhaud in France, De Falla in Spain, and the Finn, Jan Sibelius, whose symphonies rank with those of the great masters Sir Charles Parry and Sir Charles Stanford began a revival in English music towards the end of the last century, and Frederick Delius, more recently, has had the deepest influence of all modern British composers Sir Edward Elgar is known especially for his symphonies and for his oratorio, "The *Dream of Gerontius*" Gustav Holst, Ralph Vaughan Williams, Sir Granville Bantock, Sir Arnold Bax, and William Walton (the youngest and most promising of post-War composers) have all helped to make English music more widely known and more generally appreciated

In recent years the gramophone and broadcasting have popularized all music to an extent that has never been achieved

A FIFTEENTH-CENTURY ORGAN

The angels in this famous painting by Hubert and Jan Van Eyck (1420) are playing a "positive" (portable) organ, a harp, and a violin This is a panel from the Ghent altar-piece, 'The Adoration of the Lamb'

FAMOUS HOMES OF MUSIC IN TWO CONTINENTS



The top photograph shows the orchestra and organ at the Queen's Hall, London during one of the Promenade Concerts conducted by Sir Henry Wood under the auspices of the British Broadcasting Corporation for eight weeks from the beginning of August. The lower photograph is of the Metropolitan Opera House New York, seen from the stage. This the most famous centre of music in the United States, is used sometimes for grand opera and sometimes for concerts

Photos P I C Blue Bird

before At first it was thought that these inventions would empty concert-halls, but instead the public appetite for music seems to have been whetted by them, and far more people now go to concerts—especially the famous London Promenade Concerts at the Queen's Hall—than formerly

For the outstanding names in the history of music, *see* separate articles and list under Music in Fact-Index

The Musician's Career

Professional musicians may be divided into three main sections performers, teachers, and composers To the first of these belong solo artists, whether pianists, violinists, vocalists, etc, conductors, singers in the opera and the choirs of churches and cathedrals, and, most numerous of all, members of orchestras and bands for restaurants and dance-halls The second group includes professors of music at universities and colleges and teachers of music, who are employed now in most large schools The third class includes composers of various types of music, and writers on music, including the critics

The musician's training is usually taken in one of the colleges of music in London or the provinces, and there are a certain number of scholarships in music at the universities of Oxford and Cambridge which give degrees in this subject The curriculum of a college of music includes weekly lessons in at least two subjects—for example, piano and singing, or violin and clarinet—as well as attendance at lectures and classes The colleges usually give a diploma or other recognition to those students who have passed their examinations The representative body of the profession is the Incorporated Society of Musicians, 19, Berners Street, London, W 1

In London the schools include the Guildhall School of Music, John Carpenter Street, E C 4, London Academy of Music, Harrington Road South Kensington, S W 7, Royal Academy of Music, York Gate, Marylebone Road, N W 1, Royal College of Music, Prince Consort Road, South Kensington, S W 7, and Trinity College of Music, Mandeville Place, Manchester Square, London, W 1

Musical Instruments.

If you stretch a string or wire tightly and pluck it, the string vibrates and makes a pleasing sound Or if you close one end of a hollow tube and blow into the other, the air in the tube is set vibrating and makes a different sort of sound Again, if you strike a thin piece of leather stretched over a box, or a piece of metal suspended by a string, you get another kind of sound caused by the vibration of the leather or the metal

From these three modes of causing sounds come all the various kinds of musical instruments When you first look at the piano, the organ, and the many instruments used in bands or orchestras, they seem very different from each other But a little observation will show you that they all fall into these three great groups or families, according to the way they produce their sounds Those in which the sound comes from vibrating strings are known as *stringed* instruments, those in which a column of air is set in motion are called *wind* instruments, those which themselves are set vibrating by being sharply struck are called *percussion* instruments

How Stringed Instruments Give Tongue

Of these families the string group is the largest The piano (*q v*) is its best-known member Open the case and you find the strings They are of wire and are stretched across a great sounding board of fine strong wood that will not crack or warp Now, with a quick touch press one of the keys in the centre of the keyboard You will see that you cause a little felt hammer to lift away from the string, and at the same time a little metal hammer to strike the string When this happens you hear a tone

Now take your finger from the key, and you will see the little felt hammer fall back against the string, at once the tone is hushed This is because the felt pressing against the string stops the vibrations Sound a key well down towards the left-hand end of the keyboard, the tone you will hear is much deeper This is because the bass strings are so much heavier and longer that they vibrate more slowly and the tone that reaches your ear is duller

One of the Oldest of Music-makers

The harp has almost as many strings as the piano, but all except those in the bass are made of catgut, and instead of being struck, they are plucked with the fingers Most of the harp tones are thus made without vibrations of any metal, and are therefore much sweeter and richer than the tones of the piano When you hear a harp, you will recall the story about the boy David, who, thousands of years ago, played upon his harp to soothe the suffering king For the harp is one of the oldest of all instruments Read its story, how it has sung its way from a bow-string to the proudest place in music (*See* Harp)

Other less important stringed instruments also plucked, but held across the body, are the guitar, the mandolin, and the banjo The zither has a horizontal "table" of strings

The violin (*q v*), the most important member of the string family, is played in a different manner Instead of being plucked or struck, its strings are usually set vibrating by drawing a horse-hair bow across them, though occasionally harp-like effects are obtained from it by plucking (called *pizzicato*) Closely related to the violin are the viola, violoncello, and double bass, which

PAN'S PIPES AND SOME OF THEIR PROGENY

When the Greek god Pan invented his rude "Pan's pipes," as the old Greeks fabled, he little thought what a tremendous family of musical instruments would come from them Here we see a few of their descendants (1) Fife, (2) Flute, (3) Clarinet, (4) Bassoon, (5) Violin, (6) Violoncello, (7) Double Bass, (8) Ancient Trumpet, (9) Castanets, (10) Lyre, (11) Cymbals (early), (12) Ancient Harp, (13) Bugle, (14) Modern Trumpet, (15) Cornet, (16) Tambourine, (17) Trombone (18) Saxophone, (19) Bagpipe (20) Tuba, (21) Triangle (22) Helicon, (23) Harp, (24) Guitar, (25) Mandolin, (26) Ocarina, (27) Kettle Drum, (28) Snare Drum, (29) Bass Drum and "Traps," (30) Zither, (31) Piano, (32) Pipe Organ, (33) Accordion, (36) Harmonium The Tuning Fork (34) is used to give true pitch, and the Metronome (35) to mark time

are larger forms of the same type, producing deeper sounds by reason of their greater size

Now we come to the great family of wind instruments The flute, probably the most ancient of all musical instruments, is the typical member This is simply a closed tube in which the air is set in vibration by blowing into it through a hole in the side A smaller form of the flute with a shriller sound is called the piccolo

After the invention of the flute men discovered that they could get different and more varied effects by using a longer tube with a mouthpiece against which their lips would vibrate Thus originated the wind instruments of the horn and trumpet type Very long tubes are required to produce a deep tone, and so in most instruments of this kind the long tube is curved into a more or less circular form

In one type, the trombone, the tube is made in two parts, one fitting into the other, so that it can be drawn in or out and thus made shorter or longer The familiar cornet and the great bass tuba are also members of this group, which is known to musicians as the " basses "

There is another group of wind instruments known as the " reeds," because they have reeds in their mouthpieces These reeds are set in rapid vibration by the breath, and they in turn start the air vibrating in the tube, thus producing the sound Among the common reed instruments are the oboe, English horn, bassoon, clarinet, and saxophone

Now we come to the percussion instruments, those that themselves vibrate when struck They are of two chief kinds, drums and bells Everyone knows the big bass drum and the smaller drum, which are so much used in bands to mark the time and to produce rumbling martial effects These drums produce indefinite sounds of no fixed pitch, but there is another kind, the kettle-drum, which can be tuned to a definite pitch and is much used in orchestras (*See* Drum) In the bell group are such instruments as the triangle, the glockenspiel, the xylophone, the celesta, and the cymbals

The great pipe organ and the smaller cabinet or reed organ are merely improved wind instruments In these the air supply is fed by means of bellows instead of the player's breath, and a great number of pipes or freely vibrating reeds is brought under control by means of one or more keyboards (*See Organ*)

In addition to these more important musical instruments, there are a great many minor instruments (*See* illustration in page *2859*)

Since each musical instrument has its characteristic " timbre " (quality of tone) and strength of note, composers have a tremendous variety of musical effects which they can use in expressing their ideas (For explanation of the difference in quality between instruments, *see* Sound) Even the existing variety, however, is not enough, and many composers have invented special instruments to produce particular effects for certain compositions

MASSIVE MUSK-OX

With its long, shaggy coat of hair, its heavy build, and its huge horns meeting across the top of its head, the musk-ox is a strange-looking beast, yet it is agile and quick in its movements One can see from its appearance that it is well-equipped for existence in the icy wastes of America's Far North

Canadian Official News Bureau

Musk-deer. (*Moschus moschifera*) From very early times this animal has been hunted for the very sweet-smelling musk which it yields Neither male nor female has antlers, but the male has sharp tusks projecting downward from the upper jaw which are used in fighting

Musk-deer inhabit the thickets on the slopes of the Himalayas in Central Asia, usually living alone, rarely in pairs, and never in herds A full-grown specimen is about 3 feet long and 20 inches high at the shoulders They vary in colour, but are commonly greyish or yellowish-brown, and whitish below

The musk is found in the male only, in a sac the size of a very small orange, situated on the under surface of the abdomen The sac contains an ounce or more of the crude musk, which, when fresh, is said to resemble moist gingerbread in colour and consistency Because of its powerful and enduring odour, this substance is of great value in making perfumery, and is an important article of commerce throughout Asia, the deer are caught by trapping

Musk-ox. In size and shape the musk-ox, *Ovibos moschatus*, resembles the ox, but in habit it is like the sheep, and hence it is sometimes called, also, the musk-sheep It is very agile, swift, and sure of foot It is now restricted to Arctic America, but formerly it was more widely distributed and was found in Europe

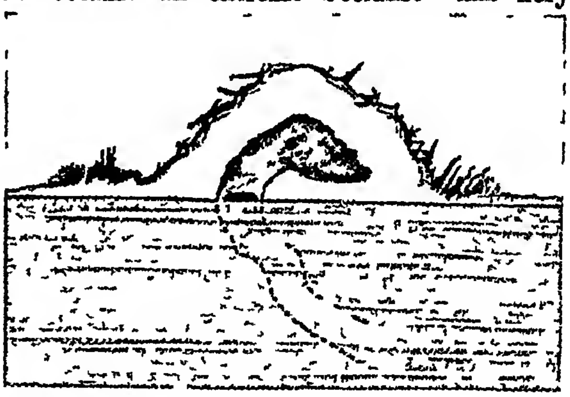
The musk-ox is a strange-looking creature, covered with long hair, tangled at the shoulders The legs are short and erect, the head massive, the tail very short, the horns meet in the middle of the forehead and curve downward and

outward, with the tips pointing upward The coat next to the body is very fine and soft, of a light brown colour, the outer hairs are coarser, darker, sometimes a foot long The hairy coat is shed during hot weather A full-grown male reaches a weight of 450 lb The animal gets its name from its peculiar musky odour, which is not due to a gland as in the musk-deer

Musk-oxen live in herds and feed on grasses, lichens, moss, willow, and pine shoots, the flesh and milk provide important food for the Eskimos, who can domesticate these creatures

Musk-rat. Perhaps no animal shows so well the dangers of interference with the "balance of Nature" as the musk-rat (*Fiber zibethicus*) This rodent is a native of North America, where it is trapped and farmed for its fur ("musquash"), and in 1907, in the hope of making this a valuable fur-producer in Europe, a pair were turned loose in Austria Free from their natural enemies, these beasts spread all over Central Europe with amazing rapidity, so that they have now for years been a permanent and ineradicable pest, costing many thousands of pounds annually to the governments of countries in which they are established, and always threatening to spread further afield Wherever they settle, these creatures undermine the banks of rivers, canals, and lakes, make swamps of the fields surrounding these stretches of water, and ruin the drainage systems of all land they live in

In 1927 a few musk rats were brought to England for fur-farming, but, realizing the danger—for the beasts cannot be prevented from escaping—the Ministry of Agriculture forbade any further importations Some of the musk-rats had already escaped and were doing damage, but these were soon killed off Yet it was not until 1937 that the Ministry could really claim that the "musk-rat menace" was over



W S Berridge

THE MUSK-RAT AND HIS HOME

Above is a musk-rat, a creature that does much damage to the banks of rivers and lakes On the right is its "lodge," composed of a thick mass of dead reeds and vegetation, and entered by a door beneath the level of the water

A full-grown musk-rat is over a foot long, very heavily built, with a tail of nearly another foot The fur is red-brown The creatures live in burrows in the banks of stretches of shallow or stagnant water, and in the middle of lake, stream, or swamp they construct "lodges," huge mounds of bitten-off reeds and vegetable refuse These houses provide winter food for their inhabitants, and are devoured from the inside outwards Reeds, floating on the surface and sharply bitten off at the ends, are the invariable sign of musk-rat presence, if you ever see them, and can be sure that they really are bitten off—not just torn off by floods or other agency—you should at once report the matter to the local authorities For even if one pair of musk-rats survive in the wild in Britain, these will breed with such rapidity as to infest a new area before the damage they have done may be discovered and so make their presence known

Mussolini, BENITO (born 1883) The career of Signor Mussolini reads like some strange fairy-tale The son of a blacksmith, he was born in the Italian province of Forli, July 29, 1883 He became successively school teacher, butcher's boy, bricklayer's helper, journalist, teacher of French, editor, soldier, member of parliament, revolutionary leader, and, finally, dictator of Italy—all before he was 40

Though he was educated for the profession of teaching, his chief interest was in politics, and he became an extreme Socialist His fiery utterances led to his expulsion, first from Switzerland, where he had gone to continue his studies, in poverty-stricken circumstances, at Lausanne, and later from the Trentino, then under Austrian rule Continuing his revolutionary propaganda in Italy, he was sent to prison, on his release he became editor of the official Socialist paper, "Avanti"

During these years, however, his ardour for Socialism had been waning, and when the World War broke out in 1914, he left the Socialist party and founded a new paper ("Popolo d'Italia"), through which he urged Italy to join the Allies He himself fought in the ranks until he was wounded Then he returned to his work of firing the national spirit for victory

After the Armistice, when Italy began to drift into Communism, Mussolini organized the Fascisti, a body of ardent patriots, and between them, on the one hand, and the Socialists and Communists, on the other, violent clashes were frequent all over the country

The bloodless revolution of October, 1922 (the "March on Rome") made Mussolini Prime Minister with dictatorial powers But, while drastically changing the real government of Italy, he wisely worked with the old and familiar machinery

Keystone

BENITO MUSSOLINI, ITALY'S 'DUCE'

The youth of Italy is one of Signor Mussolini's chief cares, for he looks upon them to uphold the Fascist regime in the future He is here seen at a review of young Fascists in Rome

First, he put an end to the widespread corruption, waste, and inefficiency, placed both Capital and Labour under state control, abolished strikes and lock-outs, and increased the corn crop 25 per cent by sending experts to teach the farmers

The change of government he has since effected is profound The king remains, but all actual power is centred in the hands of Mussolini as Prime Minister The Senate has no real authority, and the composition of the Chamber of Deputies is controlled by the Grand Fascist Council The cabinet ministers are merely the Premier's executive agents, and Mussolini has himself held as many as eight portfolios at once With the appointment in 1934 of the 22 "corporations" composed of masters and men, to direct the economic life of the country, the way has been paved for the replacing of the parliamentary regime by the "Corporative State," under the final authority of "the leader," *Il Duce* (pron dōō'-chā) (*See* Fascism, Italy)

No man could hold such power and escape the epithet of "despot" However, in spite of Mussolini's suppression of hostile newspapers and other critics, his theatrical manner, his love of military display, and his aggressive speeches, no one who visits Italy can fail to be struck by the great awakening of the Italian nation

English people, accustomed to taking energetic action on momentous issues, find it particularly hard to realize the fatalism on which Italy had gone aground as the result of years of diplomatic subservience Italians suffered from an "inferiority complex" They had grown accustomed to the idea that other nations were more efficient, more powerful, richer, cleverer in their response to difficulties In shaking Italy out of this feeling of futility, Mussolini will at least have left a legacy of immeasurable value His aggressive foreign policy, which reached its culmination with the annexation of Abyssinia in 1936, had the same end in view—to arouse a spirit of national unity But Mussolini's militarization of the entire nation, and his decision late in 1937 to leave the League of Nations, have made the other Powers more and more apprehensive of his eventual aims His visit to Herr Hitler in Germany shortly before was the signal for general acclamation in both countries immediately concerned, but it left the world as uncertain of the purpose of the two dictators as did their—and especially Italy's—participation in Spain's civil war Moreover, his anti-British propaganda in the Near East and his scarcely-veiled designs in the Mediterranean tended to create grave suspicions in Britain and France

As for material benefits, the Mussolini regime has increased the mercantile marine, planted new forests, built roads and aqueducts and new towns, reclaimed millions of waste acres, unearthed the ancient glories of Rome and Italy's other great cities, established a network of air-lines, and "tyrannized" the railways out of their former inefficiency His political wisdom in the domestic sphere was shown by his reconciliation with the Pope in 1929, by which the independence of the Vatican State was recognized

Mustard. Though mustard has been used both as a table condiment and as a medicine from remote times, we owe the idea of grinding the seeds of the mustard plant and sifting out the flour to Mrs Clements, a resident of Durham, who hit on the process in 1720 The new form of mustard rapidly became popular.

The seeds, which are very tiny, some weighing not more than one-fiftieth of a grain, are cleaned and crushed between rollers, and the oil is extracted by pressure After the cake is dried it is ground and bolted to remove the husks Mustard is used medicinally in plasters and as an emetic in cases of poisoning, and it is grown and ploughed in as a valuable manure

The mustard plants belong to the genus *Brassica*, which also contains numerous types of cabbage The black mustard (*B nigra*) provides the condiment, the white (*B alba*) being used agriculturally Other wild plants bear the name, such as garlic hedge mustard (*Sisymbrium alliaria*), also known as "Jack-by-the-hedge" All belong to the order *Cruciferae* The commonest wild mustard is the plant called charlock (*B sinapistrum*)

GATHERING THE MUSTARD HARVEST

In Cambridgeshire and the neighbouring counties fields of mustard such as this are grown and reaped every year to supply the hot-tasting, yellow condiment As you can see, the bristly, branching plants grow to a height of about three feet Mustard powder is often a mixture of the ground seeds of white and black mustard, with wheat flour, coloured with turmeric

J & J Colman Ltd

Mysore. Among the 560 native states of India, few have greater historical interest for British boys and girls than Mysore, whose ruler, the Mahomedan adventurer, Haider Ali, and his son Tippoo, caused our settlers so much concern and fighting in the latter part of the 18th century They overran the Carnatic and besieged the British in Madras, until Sir Eyre Coote relieved the city and concluded a peace with Tippoo in 1784, Haider Ali having died two years previously

In 1790–1792 the crafty Tippoo was again in the field, and only submitted when the British, under Lord Cornwallis, were at the gates of his capital Bribed and secretly aided by France, the redoubtable rebel for a third and last time measured his strength against the British in 1799, but this time he was up against Colonel Wellesley, later Duke of Wellington, and he was utterly crushed at the battle of Seringapatam, in which he died bravely defending the breach in the city walls

Since those stirring days the state of Mysore has prospered peacefully, and a close understanding has long been in force between its Government and the Madras Presidency By a treaty in 1913 the British India Government was assigned the town and territory of Bangalore, and this forms the chief military station in Southern India It has been the administrative capital of the state since the British occupation in 1831, although Mysore City remains the dynastic capital

Mysore lies on the Malabar coast and is practically enfolded on the land side by the Madras Presidency It covers 29,326 square miles, with a population of over 6,550,000 It is a very prosperous state, its fertility being in a large measure due to the fact that it occupies a healthy plateau which receives both the north-east and south-west monsoons Agriculture occupies two-thirds of the population, and rice, tea, coffee, cotton, and oil-seeds are exported The silk and gold-mining industries are valuable, and quantities of manganese and mica are mined

The ruling prince is a Maharajah, who is entitled to a salute of twenty-one guns Mysore City has a population of some 90,000, and among its buildings are to be noted the new Palace, the old fort, the residency house (first built for Colonel Wellesley), and the new university, established in 1916

Mythology. When primitive Man first sought to understand how the world had come to be as it is, and how the sun, moon, and stars followed their regular courses, he invented stories of beings like himself, but immeasurably greater and immensely more powerful According to some of these stories, or myths as

they are called, one such being had originally created Man, and taught him what to eat and other useful things

Myths of these kinds have been traced among the ancient civilizations of Babylonia and Egypt, and many are still current among backward tribes, but it is to the Greeks, who were a nation of poets, that we owe the most beautiful stories of gods and heroes, and it is their mythology that has made the deepest impression in literature

It is an interesting and instructive fact that many of the myths found in lands far apart are remarkably alike Many of the Greek myths are like not only those of India and of Egypt, but also those of the Norse countries, and even, in some cases, the myths of the American Indians Both Nature and men are much the same all the world over, and it is but natural that the first attempts to find answers to the riddles of the day and night, the earth and sky, the sun, moon, and stars, should have resulted in similar stories

It is, perhaps, even more interesting to see how each race has stamped its own character upon its mythology The mythology of the Greeks reflects their joy in life and love of beauty The Norse mythology breathes a warlike spirit, and shows the conflict with stern and rugged forces of Nature That of the Hindus is full of awe at the mysterious and sublime powers of Nature The mythologies of savages are almost unbelievably childish and absurd Their gods are often represented as beasts The bushmen of Africa regard an insect, the mantis, as the highest of their supernatural beings The Zulus worship their ancestors, which appear to men as snakes

Besides the beliefs still held by savages and by the less educated classes in such countries as Russia, Japan, India and China, and besides the nursery stories—myths of Jack the Giant Killer, etc —there is a constant tendency for myths to spring up in connexion with men and events which appeal to our sense of the great and marvellous But the spread of science and the preservation of records, together with the love of accuracy fostered by our historians, tend to prevent the formation of myths and to break down the belief in old ones Mythology, however, is an important part of history, for the light it throws on early ideas

In the second place, mythology is also a part of literature, and we cannot understand the literature of the early peoples without knowing something about their mythology Especially is this true of Greek and Roman literature, and—what is most important of all for us—as this literature has had a profound influence upon that of today, so has the old mythology become interwoven with the very fabric of our literature To understand a single page of Milton's "Paradise Lost," to appreciate fully the beauty of Shelley, Keats, or Byron, of Tennyson or Browning, one must be familiar with these old myths, for they have become a part of the very thought and language of these and other English poets

MYTILENE'S SPACIOUS HARBOUR

The capital of the Island of Mytilene has a population of about 27,000, and its fine natural harbour makes it the chief port of the island The capital was originally built on a smaller island off the east coast, but this was afterwards joined to Mytilene by a causeway, and the chief part of the city (seen above) is now on the main island

Mytile'ne (LESBOS) In this beautiful island of the Aegean Sea, now called by its early name Lesbos, Greek lyric poetry flourished It was the birthplace of the musician Terpander and also of the poet Alcaeus, and the poetess Sappho

With an area of 675 square miles, it is mountainous and very fertile Olives are the principal product and are largely exported

In 1462 the island came under Turkish control and so remained until the close of the Balkan Wars, when Mytilene and other Aegean islands passed to Greece The chief town is Mytilene population 27,870, of the island, 161,500)

THE series of little waves which formed the Egyptian sign called the "water line" www was the ancestor of our letter N. When written in running hand, the undulations tended to disappear and the character assumed the form which looked more like a fish. The Phoenicians and Hebrews called it *Nun*, the word for "fish" in their language, but they still further modified it so that we might be inclined to say it looked more like a fish hook than a fish. So it passed to the early Greeks and Latins, who, straightening the lines and making them of more even length, evolved the letter N. As M is a labial or "lip" nasal, so N is a dental or "tooth" nasal. The sound is made by bringing the end of the tongue in contact with the upper teeth, or gums, and sending the breath through the nose while the vocal chords are vibrating. The contrary is true of the French "nasal *n*," the nose passage being closed and the breath sent through the mouth.

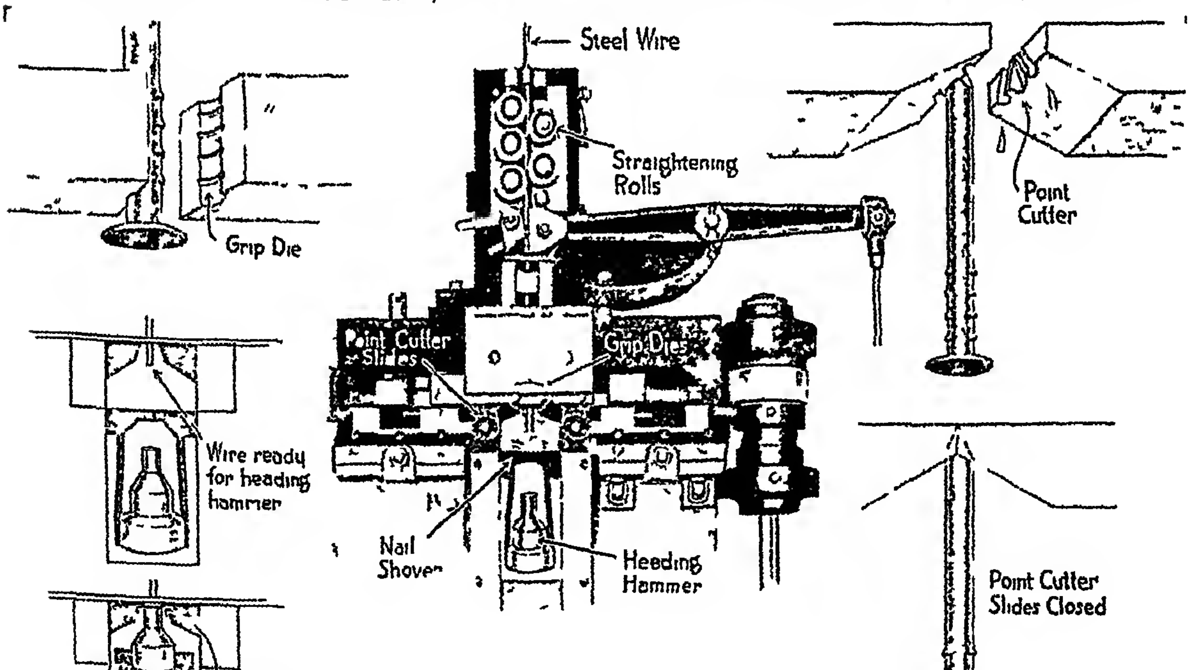
Nagoya, JAPAN. Nagoya is the third of the important cities of Japan. It is situated 30 miles from its port on the Grand Trunk Railway, 235 miles from the capital, Tokyo, and about 94 miles from Kyoto.

Nagoya is famous for its potteries, and a dozen miles distant is Seto, where the first glazed pottery was made in Japan after its secret had been learned in China in 1229, by Kato Shirozaemon. Nagoya is also the home of the exquisite enamels of Japan, and it was in Nagoya that the first cloisonne ware was made. The most interesting building is the castle of Nagoya's feudal rulers, the Owari, now an art museum. Nagoya is a distinctly modern industrial city with a population of about 1,083,000.

Nails. Did you ever see a nail-making machine at work? At one end soft steel wire is reeled into it at a tremendous rate, at the other end it pours out a stream of bright nails—a thousand a minute—with a roar like a machine gun or a pneumatic riveter in action. Powerful nippers cut the wire into the required length, pliers fashion the point, and the head is formed by a hammer which strikes a terrific blow on the other end—and the nail is finished in a second.

What a difference from nail-making in olden days, when every nail was laboriously hammered out by hand on an anvil! Many of the country folk had small forges in their chimney corners, and there, on winter days and in the long evenings, when little other work could be done, quantities of nails were made, even by the older children. The nails were forged from "nail-rods" heated on the small hearth, and hammered and cut into the proper length.

Now, all we need do is to insert the end of our coil of wire into the machine, turn on the



MAKING A THOUSAND NAILS A MINUTE

This group of pictures shows you how a wire is made into nails. After entering the machine and passing through the straightening rolls the wire is caught by the grip die, which puts on the studs. Then the cutter closes upon the wire and cuts the point, while the heading hammer comes up against the lower end and flattens out the head. As soon as made, the nails are knocked off from the parent wire by the "nail shover" and fall into a basket at the rate of one thousand a minute!

power, and from time to time place a new keg to catch the nails as they stream out at the rate of from 100 to 1,000 a minute according to size

The first man to invent a nail-making machine was Ezekiel Reed, an American, who took out a patent in 1786 His machine in an improved form is still used for making cut nails Strips of metal the thickness of the nail are fed into the machine, and a "slicer" cuts them into square-sided nail lengths, which are firmly clutched at the neck while the upper end is hammered in to a head These cut nails taper, but are not pointed In 1790 a nail-making machine was invented by T Clifford in England About a century afterwards the wire nail came into general use, almost driving out the cut nail, although the latter holds better and is more durable

Wire and cut nails are made of various metals—iron, brass, copper, zinc, etc —and in a great variety of forms, such as, for example, shingle nails, finishing nails, barbed box nails, flooring nails, boat nails, trunk nails, and picture nails They are usually sold by weight the price increasing as the nails grow smaller, and are distinguished in size as twopenny (1 inch), threepenny ($1\frac{1}{4}$ inches), fourpenny ($1\frac{1}{2}$ inches), so on up to the 60-penny Nails less than an inch long are called tacks and brads Birmingham is the chief centre for nailmaking in England

Nairnshire, SCOTTISH CO The fourth smallest county in Scotland has an area of just over 160 sq miles and a population of only 8,294 Lying in the north-east and bordering the Moray Firth, it enjoys a fine, equable climate, and its alluvial soil in the "Laigh," or coastal plain, is very fertile Four-fifths of the county, however, is hilly, but the heath and pasturage support large numbers of sheep The Findhorn and the Nairn are the chief rivers

Apart from agriculture, the industries are few and small, the chief being distilling, tanning, and sandstone and granite quarrying The county town is Nairn (population, 4,200)

Names. Why should there be so many persons who bear the surnames of Smith and Brown ? Let us find out by going far back into the history of names—one of the most fascinating and romantic of studies, because every name has a meaning and a story of its own

In very early times each person had only one name—his "given" name—which he might receive at the time of birth or later Where men lived in small tribal groups, this single name was enough But in larger communities there would be many of the same name, and so it became necessary to add some qualification—perhaps the name of the father—as a distinction. Thus you could distinguish between two men of the same name by calling one Demosthenes "the son of Clinias," and the other Demosthenes "the son of Socrates" Sometimes the name of the birthplace was added, and in many cases a nickname (*q v*), denoting some personal peculiarity, would be used to make a distinction between people with the same name Thus one Demosthenes might be called "of Athens," and another "the Lame" With the Romans this practice developed into the use of genuine "family names" (*cognomina*), which descended to all members of the same house, in addition to the "personal name" borne by the individual In the name Gaius Julius Caesar, Gaius is the *praenomen*, Julius the *nomen* (name of the gens or clan), and Caesar the *cognomen* or family name

How Surnames were Invented

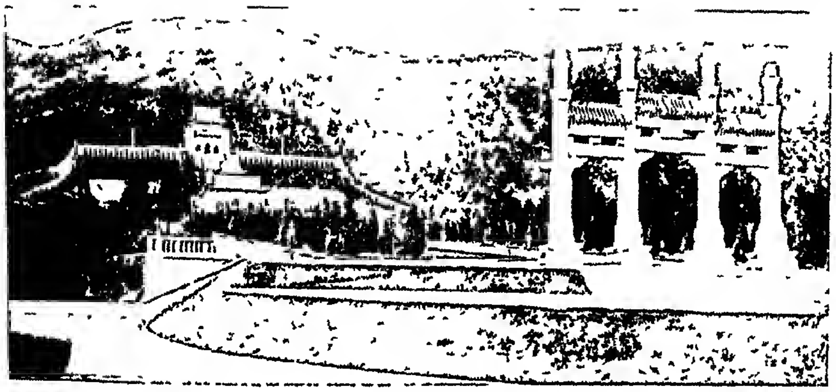
Family names did not arise as a usual thing until after the time of the Norman Conquest (1066) There were so many Johns and Samuels and Williams that it became convenient to refer to a man as John the *smith*, John the *miller*, or John the *carpenter*, and so presently these designations became fixed as surnames or family names The names Taylor, Wright, Turner, Clark (clerk), Cook, Carter, and Gardiner are a few of the many derived in this way from occupations The reason there are so many Smiths today is that in medieval times the name was applied to all smiths or workers in metal—blacksmiths, goldsmiths silversmiths, locksmiths, etc

Another common way of forming surnames was from the Christian name of the father Such names are called *patronymics*, meaning "father-names" Johnson is simply "John's son," and Jones and Jennings are modified forms of the same surname

The name of Brown was first given to a man as a nickname because of his complexion, or possibly because of the colour of his dress In like manner such names as Long, Short, White, Little, Longfellow, and Cruikshank were originally derived from personal characteristics Other names were derived from the place where a man lived or from which he had come, as Hill, Cliff, Field, Whitfield, Dale, Ford, Lake, Wood

Biblical characters and saints have furnished many surnames Adam has given the familiar names Adams, Adamson, Ade, Atkins, and Atkinson, all of which mean "the son of Adam" From Elijah come Ellis and Eliot, and so on

In most other languages surnames are formed in much the same ways as in English Corresponding to the English suffix *son*, we find the Scots prefix *Mac*, the Irish *O'*, the Norman-French *Fitz*, and the Welsh *ap*, which give us the names Macdonald, O'Brien, Fitzherbert, and Bowen (originally ap Owen) The Russian suffix *-ovitch* likewise means "son," hence the Russian name Ivanovitch, son of Ivan, or John, corresponds to the English Johnson



Central Press

NANKING'S MEMORIAL TO A NATIONAL HERO

Just outside the city of Nanking is the tomb of Sun Yat Sen the Chinese Republican leader who died in 1925 and whose memory is still held in reverence in China His body was interred in the mausoleum seen on the left of the photograph in 1929 The approach to the tomb is a magnificent, tree-lined avenue, cut directly through the old city and extending to the banks of the Yangtse river The mausoleum and the arch in front of it show modern Chinese architecture at its best

Place names are a particularly interesting subject of study In Britain, almost the only relic of the Celtic peoples are names like *Avon*, *dun* (a fortified hill), *aber* (a meeting-place of two rivers), and *ben* (a mountain) The Danish invasion of East Anglia has left its mark in terminations like *by* (a village) Saxon suffixes include the very common *ton* (a town) and *ham* (a hamlet) Other names often show the military nature of the Roman occupation *Castra* (a camp), for example, gives us names like Chester, Doncaster and Winchester

Nanking, China More than 2,000 years ago, Nanking was an important city, and in the course of its varied history it has seven times been the capital of China Its name means "southern capital" The city's greatest glories began in 1368 under the first Ming emperor He saw the long undulating line of hills rising from the bank of the river Yangtze like the sacred dragon's body, and decided that on the dragon's back he would build his capital A wall 28 miles long, 60 feet high, and about 30 feet thick was built around it The famous white porcelain pagoda, whose five large pearls were believed to safeguard the city from danger, was begun in 1413 During the Taiping Rebellion in 1853 the pagoda, palaces, and a part of the walls were destroyed

After the Nationalist government made Nanking its capital in 1928, plans were made for a subway, airports, motor drives, drainage and water-supply systems, port improvements, and centralized government buildings

Towards the end of 1937 it was attacked by the Japanese in their invasion of China, and after bombardment from land and air was compelled to surrender

On top of Purple Mountain is the city's dominant building—the imposing white marble tomb of Dr Sun Yat Sen, first president of the Chinese Republic

Nanking has long been a centre of learning, and has two universities

The city is 200 miles from Shanghai, and 700 miles north of Canton Its chief industrial products are paper, silk goods, porcelain, brassware, and nankeen cloth (named from Nanking) The population of the city is over a million

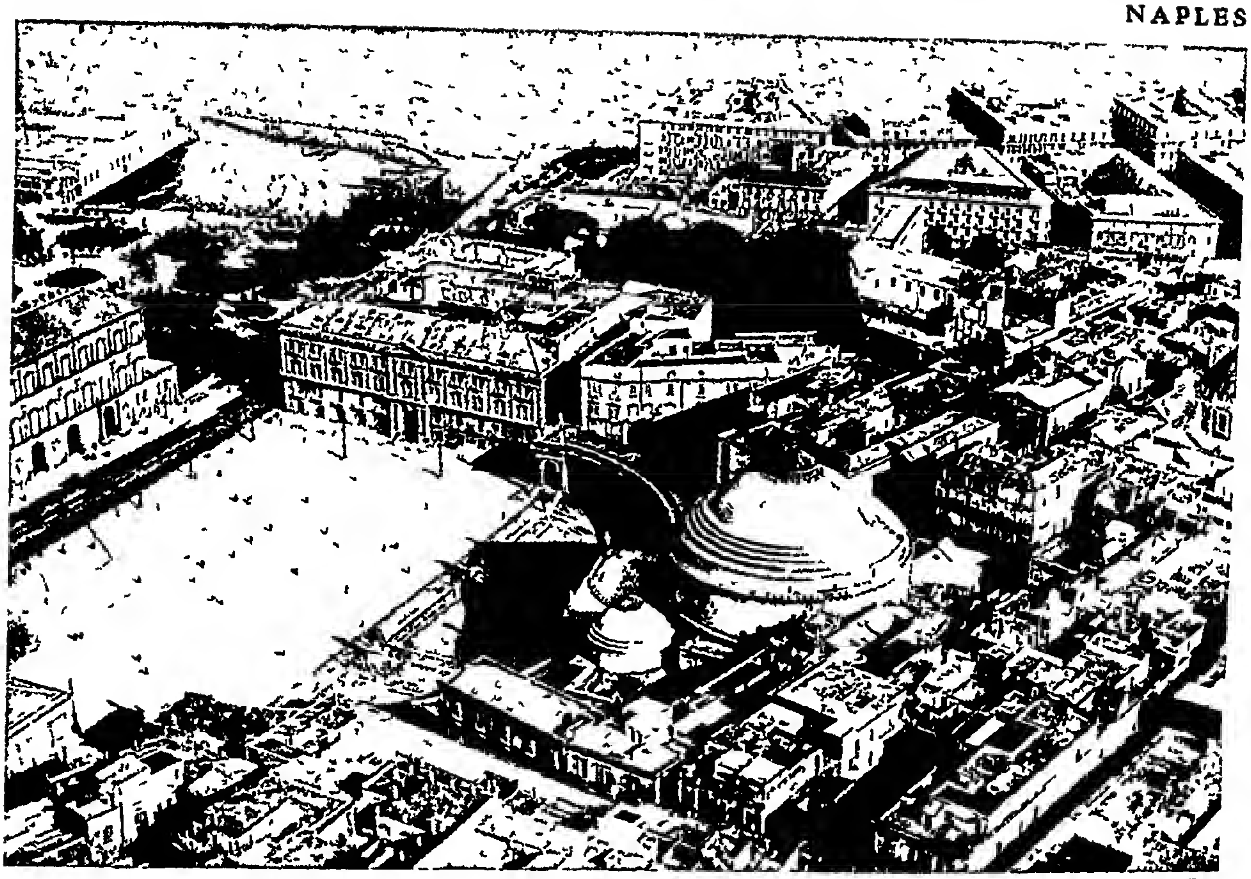
Daily Mirror

FRIDTJOF NANSEN

Dr Nansen will be best remembered as an Arctic explorer He first became famous for his adventurous crossing of Greenland in 1888 and he is here seen during that expedition

Nansen, Fridtjof (1861–1930) In the story of Polar exploration Nansen's achievements will always be remembered

He was born near Christiania (Oslo), October 10, 1861



ENIT

NAPLES, GREATEST CITY OF SOUTHERN ITALY

One of the finest open spaces in Naples is the Piazza del Plebiscito near the sea front, seen in this photograph from the air The domed building on the right is the church of San Francisco de Paola built between 1815 and 1818 on similar lines to the Pantheon in Rome Its impressive colonnade fronts on to the Piazza Opposite it can be seen a part of the Royal Palace, once the home of the kings of Naples and Sicily An enormous building, with a façade 554 feet long, it now contains the National Library Between the two is the building which was formerly the palace of the prince of Salerno

An early scientific voyage to Greenland had suggested that country as a field for exploration, and in 1887 he began to prepare for crossing the great Greenland ice-field Starting the following year, he traversed Greenland from east to west, and his book, " The First Crossing of Greenland," appeared in 1890

He then determined to test his theory of the existence of a drift-current across the Polar regions towards the east coast of Greenland In 1893 he sailed from Christiania in a specially built ship, the Fram, with the intention of fixing her in the ice and letting her drift with the current His theory proved entirely correct, and the Fram eventually came home safely by the west coast of Spitzbergen

After leaving his ship to drift, Nansen went as far north as 86° 14′, the highest latitude reached at that time His account of this expedition is called " Farthest North "

After the separation of Norway and Sweden Nansen became the first Norwegian Minister to England He took a prominent part in repatriating prisoners of the World War and in relieving sufferers from famine in Russia In history Nansen's name will go down as a great courageous explorer and as a broad-visioned succourer of stricken humanity He died May 13, 1930

Nantes, France (Pron nahnt) In its long and varied history, the most memorable event associated with Nantes was the issuing of the famous Edict, by which Henry IV in 1598 granted toleration and civil rights to the Huguenots or French Protestants

Today its position on the estuary of the river Loire, about 50 miles from the sea, and its chain of connecting canals make it one of the chief seaports of France Sugar, tobacco, sardines, and preserved foods, with ironworks and ship building, are the principal industries The population of the city is about 195,000

Naples, Italy To catch the spirit of Naples the visitor must see it first as he sails between the islands of Ischia and Capri, and enters the celebrated Bay of Naples, some 22 miles wide There, at the bay's northern apex, lies perhaps the most picturesque and most fascinating of Italy's historic cities As the ship ploughs forward, through the bluest of waters under the bluest of skies, the sloping city appears, flanked seven miles to the east by the ominous bulk of Mount Vesuvius, with its smoking crater, and

NAPOLEON'S FLIGHT FROM WATERLOO

THE battle of Waterloo was fought on June 18, 1815, and when Napoleon realized that he was hopelessly defeated he left the field to hasten back to Paris He was two days on the journey, arriving in Paris on June 20 Only a few months before, after his escape from Elba, the Emperor had had a tumultuous reception from the French people, but now he was a broken man, his great army was retreating in disorder, and the bitterness of defeat was upon him His journey was made at top speed, and was broken only by brief rests at wayside houses In this picture, by Marcus Stone, R A, he is seen dejected and forlorn, crouching before the fire in the humble cottage of a peasant ex serviceman who with his wife and children regards the fallen Emperor with mingled pity and awe

Guildhall Art Gallery London

NAPOLEON ON THE RETREAT FROM MOSCOW

The beginning of the end of Napoleon's domination of Europe began in 1812 when, with an army of 600,000 men, he marched against Russia He went on with but little opposition and on September 14, 1812, found Moscow, the old capital, practically unoccupied, the Russian army having left the city on the previous day Within a few hours Moscow, a city of highly inflammable wooden buildings began to blaze and in October Napoleon had to return, in advance of his army, leaving his men to follow Only 100,000 men survived the retreat This picture shows Napoleon with his escort leaving the burning city

Painted specially for this work by Stanley L Wood

To face page 2869

on the west by the graceful heights of Posilipo During the last century the population increased at a rate far more rapid than did the dwelling-places, and for many decades the poorer people were crowded together so thickly that disease and crime flourished unchecked in filthy tenements In 1884 a fierce epidemic of cholera broke out which carried away thousands of victims Shortly afterwards the centre of the old district was demolished and replanned Modern buildings and broad streets were built, an excellent water supply was established, and conditions improved at once

Today Naples is a centre for the manufacture of all sorts of things Machinery, guns, and other manufactures of steel and iron are of great importance, and wine is a big item of export

Naples is filled with museums, theatres, and opera houses The cathedral dates back to 1272, while the university was founded in 1224 The National Museum of Naples is one of the most important in the world In it are housed objects dug up at near-by Pompeii and Herculaneum—cities utterly destroyed by an eruption in A D 79—and unequalled Greek and Roman relics, as well as collections belonging to the Italian Crown, the Farnese group of paintings and sculpture, and 600,000 books, pamphlets, and manuscripts containing many rare historical writings A big Marine Aquarium contains the largest collection of living sea animals in the world

Naples was an old Greek settlement (called *Neapolis*, "the New City"), founded about 450 B C The Romans conquered it in 326 B C The Normans captured it about 1130, and it became the capital of the "Kingdom of the Two Sicilies" In the Middle Ages it was continually changing hands, until in 1504 the King of Spain became the ruler of the Two Sicilies In 1713 it passed to the Hapsburgs of Austria, and then in 1743 to a branch of the Bourbons While Napoleon Bonaparte was re-making Europe, his elder brother Joseph sat for a time on the throne of the Two Sicilies, to be followed by Joachim Murat, Napoleon's brother-in-law After Napoleon's fall Naples was again under the Bourbons until it became part of Italy in 1860

Naples was long the home of an infamous secret organization known as the *Camorra*, which plied its trade of robbery, blackmail, and assassination for more than a century, but in 1912 thirty of its leaders were condemned to long terms of imprisonment

The population of the city is about 870,000

The RISE *and* FALL *of* NAPOLEON

Nothing like the career of Napoleon Bonaparte has ever been seen in modern history, for anything in the nature of a parallel one has to go back more than two thousand years to Alexander the Great

Napoleon I, EMPEROR OF THE FRENCH (1769–1821) Not a drop of French blood flowed through the veins of Napoleon Bonaparte, who for 16 years was the absolute master of France He was barely a Frenchman by birth, for the island of Corsica, in which his native town of Ajaccio was situated, was handed over to France by the republic of Genoa in 1768, only a year before Napoleon was born, August 15, 1769

Napoleone Buonaparte—such was the Italian name under which he was christened—was a typical Corsican, "moody and exacting but withal keen, brave, and constant" For years his most intense emotion was hatred of France, which he regarded as an oppressor of his native land He carried this feeling with him to the military school at Brienne, to which he was admitted at the age of nine At sixteen he began his service in the French army as second-lieutenant of artillery, but even so, the stirring events of the French Revolution, which broke out in 1789, aroused little interest in him His thoughts were all on Corsica, and he absented himself from the army for long periods to engage in plots at home His schemes were not successful, however, and it was with difficulty that he escaped to France, an outcast from his native shores His love for Corsica was now dead He gave his name its French form, and he married in 1796 Josephine Beauharnais, the widow of a Frenchman (*See* Josephine)

Opportunity Comes to the Corsican

In 1793, at Toulon, Napoleon first gave evidence of his energy and genius in directing the artillery in the siege of that rebellious French city But for a time fate was against him Robespierre and the Jacobins, with whom he had established friendly relations, fell from power, and in 1795 Napoleon was back once more in Paris, deprived of his command, without money or friends, and suspected because of his Jacobin connexions

That year was the last year of misfortune for a time In October, with what Carlyle called a "whiff of grape shot," he defended the Convention against a radical Parisian mob

The Directory rewarded the young man by making him commander of the French army of Italy, against the Austrians and their allies

The campaign showed General Bonaparte's great military genius, and stirred to life again great ambition In 1796 he defeated the Sardinian troops five times in eleven days, threatened Turin, and compelled peace

Then Bonaparte turned eastwards against the Austrians His bravery was shown when, in the face of a withering fire, he forced his way across the bridge at Lodi—an exploit that won from his troops the affectionate name of the "Little Corporal" He then carried the war into Austria itself, and had advanced to within 80 miles of Vienna when the enemy offered peace By the treaty of Campo Formio France was given Belgium (the Austrian Netherlands), and accepted the Rhine as the eastern frontier of the republic and the Cisalpine Republic which Napoleon had erected in northern Italy In return he gave to Austria most of the territories of the old Venetian Republic, which he had destroyed

Napoleon next persuaded the Directory to send him to Egypt There on the banks of the Nile he expected to imitate the exploits of Alexander the Great and at the same time to strike a blow at France's most powerful enemy, England, by opening a route to India The Battle of the Pyramids, fought near Cairo (July 1798), put Egypt at his mercy, but his fleet was destroyed by the British in the Battle of the Nile at Aboukir Bay (*see* Nelson, Horatio), and he was cut off from reinforcements At Acre, in Syria, British sailors defeated Bonaparte's plans and threw him back on Egypt At last, disquieting news led him to return secretly to France

There he found the Directory discredited Bonaparte joined accordingly in a plot which in November, 1799, overthrew the Directory and set up in its place a government called the Consulate, with Bonaparte as the first of the three consuls Three years later he became First Consul for life (*See* illustration in page 1722)

Napoleon had now grasped political power and become master of France His old ambition was realized, but already new ones were forming He had failed to build up a great eastern empire He now aspired to restore the western one of Charlemagne By the battle of Marengo (1800) he defeated the Austrians and by the treaty of Amiens, in 1802, France was at peace with the whole world for the first time since 1792 But even in peace the First Consul continued to carry out his ambitious plans In the 14 months before the conflict began anew he became president of the Italian Republic, intervened in Switzerland, annexed Piedmont, Parma, and the island of Elba to France, planned the partition of Turkey and the foundation of a colonial empire to include America, Egypt, India and Australia

HOME-SICK AND SOLITARY

As a Corsican the boy Napoleon was not happy at the French military school at Brienne, and often paced the grounds alone and sullen, as you see him here He later complained that he was "always alone in the midst of men"

The powers felt compelled to renew the conflict, but still victory smiled on Napoleon By his complete defeat of the Austrians and Russians at Austerlitz (December 2, 1805), by his crushing blow to the Prussians at Jena (October 14, 1806), and by the battle of Friedland against the Russians (June 14, 1807) Napoleon brought most of Europe to his feet

Only one obstacle apparently barred his way to the complete mastery of western Europe, that was Great Britain In 1805 he had planned to invade our island and reduce it to submission But the favourable moment never came, and after England's Navy under Nelson had destroyed the French and Spanish fleets in the battle of Trafalgar (October, 1805), Napoleon had no chance to conquer Britain, for without command of the sea he could not transport his armies.

Napoleon's fame rests not only on his military genius but also on his work as a statesman A sound currency was established in France, the Bank of France created, roads and canals improved, and agriculture and industry fostered

The Roman Catholic Church, which had been suppressed in the Revolution, was re-established by an agreement with the Pope, known as the Concordat of 1801. The old confused system of law was swept away, and Napoleon founded a new system of rational law—the Code Napoleon.

Step by step now, Napoleon was building up his own position. In 1804 he secured a popular vote sanctioning a change from the Consulate to an Empire, with the title "Emperor of the French" and the right to hand down the throne to his descendants. In 1809 he divorced Josephine and married Marie Louise (1791–1847), the 18 year-old daughter of the Austrian emperor, thus allying himself with one of the oldest royal families of Europe. He set himself, also, to the work of reorganizing Europe. The Cisalpine Republic was now changed to a monarchy, and he himself was crowned king of Italy.

"Roll up that map of Europe, there will be no need for it for ten years to come," the English minister Pitt had said after the battle of Austerlitz. And for almost that period Napoleon changed the map at his will. His stepson Eugene was made viceroy of Italy. Napoleon's brother Louis received the kingdom of Holland, and Joseph became king first of Naples and then of Spain—General Murat, who had married Napoleon's sister, succeeding to the vacant Neapolitan throne. His dependants, the Dukes of Bavaria and Wurttemberg, were given the ranks of kings. The shadowy Holy Roman Empire was dissolved in 1806.

The high point in Napoleon's career was reached in the years which followed the peace of Tilsit (1807). There, on board a raft in the river Niemen, the Tsar Alexander of Russia was won over to Napoleon's plans. Napoleon and he were to divide Europe between them. In return Alexander was to aid Napoleon in his "Continental system." The object of this was to close Europe to England's commerce. At one time or another every state of continental Europe, except Turkey and Portugal, was forced into this commercial system. But all in vain.

Napoleon had aroused a great force, which was to bring about his ultimate downfall—the spirit of nationalism. In Spain the patriotic fire first blazed forth in 1808. The British sent troops to help in this "Peninsular War" (1808–14), and little by little the French forces were pushed back beyond the Pyrenees.

Austria plucked up courage to renew the struggle, but was crushed at the awful battle of Wagram (July, 1809). Then Napoleon struck at Russia for deserting his unworkable Continental system. Invading Russia, he reached Moscow. Suddenly, the day after his arrival (September 14, 1812), flames burst forth, and nine-tenths of the city was reduced to ashes. It was impossible to winter in the city, and on October 19 began the tragic retreat.

Napoleon's great career of conquest was over. The flames of national patriotism burst forth in an uprising of Europe. Austria, Russia, and Prussia all joined with Great Britain in the War of Liberation. With renewed effort Napoleon raised new armies and won a few unimportant victories, but in the three days' battle of Leipzig (1813) the French were outnumbered and outfought. Slowly but surely the allies then closed in upon Paris.

On the last day of March, 1814, they entered the French capital, and Napoleon was forced to abdicate (April 11, 1814). He was allowed to retain the title of Emperor, together with the little island of Elba. In the person of Louis XVIII the Bourbons returned.

But to remain quietly so near France without trying to regain his lost power was impossible

NAPOLEON IN HIS CORONATION ROBES

On December 2, 1804, Napoleon was crowned Emperor of the French in the cathedral of Notre Dame, Paris, and in this portrait he is seen in his Coronation robes with the orb on his right. The Pope was present to perform the ceremony, but Napoleon seized the crown and himself placed it on his head.

From the painting by H. Lefèvre, Musée de Versailles, photo Neurdein

for Napoleon In March, 1815, he slipped quietly away from Elba and landed in France As by magic an army rallied to his support, and for the brief "Hundred Days" he enjoyed a return of his former glory But the allies again united their forces against him, and on the field of Waterloo (*q v*) he was decisively and finally defeated

To avoid falling into the hands of Blucher, who had sworn to shoot him as an outlaw, Napoleon sought refuge on board a British man-of-war (H M S Bellerophon) and surrendered He was now sent to the lonely British island of St Helena, in the South Atlantic, 1,200 miles west of Africa Here Napoleon lived in exile until his death on May 5, 1821

NAPOLEON IN EXILE

The last years of Napoleon's life were spent in exile on the island of St Helena in the South Atlantic This sketch of him was drawn from life there and shows him as he was in 1820, about a year before his death It is now in the British Museum

Napoleon III, Emperor of the French (1808–1873) The nephew of the great Napoleon was only two years old when his father, Louis Bonaparte, stepped down from the throne of Holland When he was seven his uncle Napoleon fell from his proud position and was exiled to the lonely island of St Helena Then began for the boy Louis Napoleon a long period of wandering in search of a home

But wherever he was and whatever he did, he was always planning for the restoration of the Bonaparte family to rule in France This was especially true after 1832, when the son of Napoleon I—the Duke of Reichstadt—died This left Louis Napoleon as the next heir of the great conqueror His opportunity came in 1848, when a revolution drove Louis Philippe from the throne and a French republic was established Among the names of the candidates for the presidency of the new republic only one was known to the peasants—that of Louis Napoleon They remembered the glories of the rule of the first Napoleon, and by an enormous majority they elected his nephew President

Louis soon began to follow in the footsteps of his illustrious predecessor In 1851 he overthrew the old constitution and made a new one giving him unlimited power for ten years A year later he assumed the title of "Napoleon III, Emperor of the French," the son of Napoleon I being regarded as Napoleon II

The people were quite ready to give up their liberty in return for the prosperity they enjoyed Napoleon organized banks, built railways, constructed canals, established hospitals, and gave the labouring men the right to strike He also won a place among the nations by engaging in the successful war in the Crimea against Russia in 1854–56 But he longed to win military glory as Napoleon I had done, though he himself was no military genius The Franco-Austrian war in Italy in 1859 made many enemies for him His unsuccessful attempt to establish the Emperor Maximilian in Mexico still further discredited him In fact, his whole foreign policy in his latter days was a failure

In an effort to reduce the growing opposition to his rule he began granting reforms But when France was crushingly defeated in the Franco-Prussian War, in 1870–71, the Second Empire fell

EMPEROR NAPOLEON III

Napoleon I fell when his nephew, who afterwards became Napoleon III, was only seven years of age Switzerland, Germany, England and America all sheltered him for a time before he became Emperor in 1852 This painting by Flandrin shows "Napoleon the Little," at the height of his power

Musée de Versailles photo Neurdein

Napoleon gave himself up as prisoner of war when the French army surrendered to the Germans at Sedan, on September 2, 1870 (*See* illus p 1744) "Down with the Empire! Long live the Republic!" shouted the people in Paris, and on September 4 the Third Republic was born. The Empress Eugenie, his beautiful Spanish wife, fled to England, and there Napoleon III joined her. So began his second exile, which lasted until his death, three years later, on January 19, 1873.

NASTURTIUM TRUMPETS

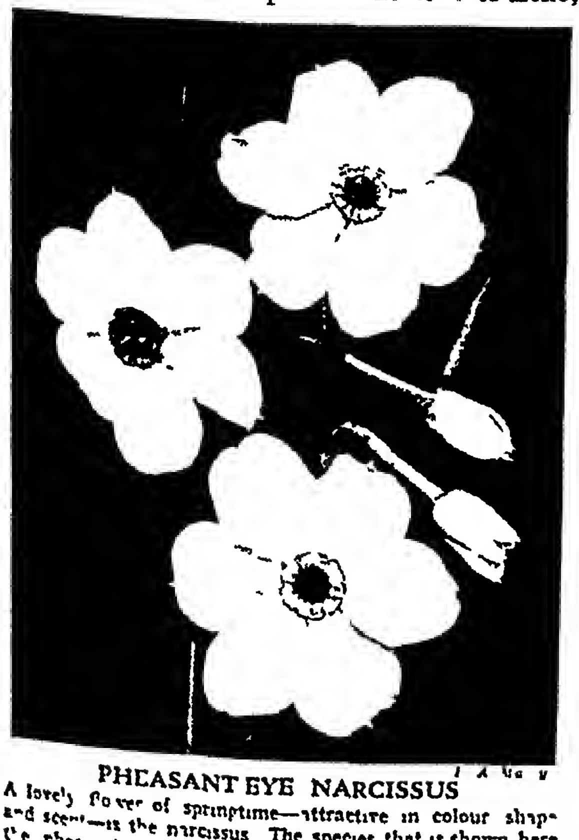
Very like a trumpet in shape are the flowers of the colourful nasturtium, but its colours are as many as the rainbow's. Here is a selection from the many varieties

Photo J E Tyler

Narcissus. Nothing makes our gardens so lovely in springtime as do the white and yellow narcissi which are planted everywhere. The blossoms, drooping from the end of a tall slender stalk, have an exquisite grace and beauty; the fragrance of some is equally beautiful.

The narcissus was beloved by the ancients. Greek myths tell of a beautiful youth, Narcissus, who, because he had spurned the love of Echo, was condemned by Nemesis to lose his heart to his own image reflected in a clear pool. Fascinated, he gazed day and night at the beautiful apparition, and became weaker and weaker from lack of food, until he pined away and died. The gods in pity changed him into this flower.

There are several species of the botanical genus *Narcissus*, including the daffodils and jonquils. One of the most beautiful is the pheasant eye narcissus (*Narcissus poeticus*), so called from the red-rimmed centre of its white flowers. The trumpet narcissus (*Narcissus pseudo narcissus*) is the common English daffodil; it is truly wild in many woodland districts, being then a smaller and more delicate plant than the cultivated forms. *Narcissus polyanthus* is the parent of the cultivated varieties with which we adorn our gardens.



PHEASANT EYE NARCISSUS

A lovely flower of springtime—attractive in colour, shape and scent—is the narcissus. The species that is shown here, the pheasant eye, is perhaps the most beautiful of all the many kinds. It is also known as the poet's narcissus

Nasturtium. Without the gay yellow, orange, or red blossoms of the nasturtium our summer gardens would be incomplete, and, besides being pretty, easily grown and ornamental, these plants keep away wasps, while flowers and leaves are used in salads and the green seeds are sometimes pickled. The flowers are curiously irregular, with five sepals united at the base and on the upper side of the flower, extending into a long, descending spur; there are 5 petals, the lower 3 fringed at the base, while the other two are inserted at the mouth of the spur. This plant, botanical name *Tropaeolum majus*, belongs to the buttercup family.

Natal, (Pron *na*-tal'), SOUTH AFRICA. Situated on the south east coast of Africa, Natal is an original province in the Union of South Africa, with an area of 35,284 square miles. It derives its name from having been discovered by Portuguese sailors (under Vasco da Gama) on Christmas Day, 1497. The province is rich in minerals, the chief product of the mines being coal. On the coast and in Zululand there are vast plantations of sugar and tea. In the level districts of the interior, where cereals of all kinds (especially maize), fruit, vegetables, etc., grow in abundance, agriculture is extensive.

Bordering the Orange Free State there rises the great barrier of the Drakensberg range, reaching over 11,000 feet in Mt aux Sources. Numerous unnavigable rivers flowing into the Indian Ocean are useful for irrigation.

Pietermaritzburg (population, 49,000) is the capital of the province, and Durban (q v) is a great seaport which handles a large foreign trade Population, about 1,940,000, of whom about 189,000 are Europeans

National Debt. Nations as well as individuals and business concerns often have debts If an orderly progressive nation has a debt in times of peace, it usually means that it has borrowed for the development of national resources and for improvements of benefit to future generations

Naturally the government does not wish to burden the present tax-payers with the entire expense, so part of the cost is postponed to a later time—that is, the government borrows money and gives the lenders bonds which show the date on which the money will be repaid, and the amount of interest that will be paid each year to the bond-holders National debt is divided into two parts—internal, or incurred to people within the country, and external, that is, owing to foreign governments, for example, Britain's War debt to U S A The internal debt is in turn divided into three parts—funded, short term, and floating debt The funded part is known as "consols," a name dating from 1751, when various government liabilities were combined in one consolidated stock It is redeemable at the option of the State and is in fact quasi-perpetual Short term debt runs for five to thirty years while floating debt applies to bonds maturing not later than after three years, and Treasury bills repayable in a few months

NATAL'S NATIONAL PARK

Natal's National Park has some of the finest scenery in the world Covering an area of 20,000 acres, it contains in its northern part a section of the Drakensberg Mountains, seen above, rising to a height of 5,000 feet above the surrounding country

Courtesy of South African Railways

External debt, especially in newer countries, has been chiefly incurred in borrowing from older and wealthier countries in order to develop untapped resources, e g , South American borrowings and those of our Dominions But in the case of a great war, when the expenses of a nation may be too large to be paid through taxation or loans from its own citizens, resort has to be had to loans from abroad Hence war loans often make up a large part of national debts

The World War added enormously to the national debt of every country that took part in it During the four years beginning with 1914–15 to the financial year 1919–1920, the National Debt of the United Kingdom was increased nearly twelve times The annual cost of the National Debt is about £224,000,000, and in 1936 the total was £7,902,000,000

National Gallery. Under a very large number of the pictures reproduced in this book you will see the words "National Gallery," and this refers to the fact that the original pictures are in our own English National Gallery, which stands in Trafalgar Square, London (*see* illustration page 2563), or else, in some cases, in the "Tate" Gallery, officially called the National Gallery of British Art, Millbank, which stands on the Thames Embankment half-way between Lambeth and Vauxhall Bridges

The National Gallery was founded in 1824, when the State purchased 38 pictures from a private collection, and by 1937 this total had risen to over 4,000 important pictures, to say nothing of innumerable drawings, etc , which are looked after in the galleries of the British Museum, but which still rank as part of the nation's collection The first purchase was made at the direct suggestion of King George IV It was housed at 100, Pall Mall, and next at 105, Pall Mall , and in 1838 it was moved to the present building

The Tate Gallery was founded in 1897 by Sir Henry Tate to contain the collection of pictures given by him to the nation, and form the nucleus of a representative modern collection Besides a very extensive range of paintings by modern British artists, there is a fine collection of modern French paintings—a few of which are shown at Trafalgar Square—as well as sculpture

There are also many pictures purchased by the Chantrey Bequest,

The chief glory of the National Gallery is its collection of Italian paintings, which include many of the greatest masterpieces of Italy's art The earlier Florentine altar-pieces are better represented here than anywhere else in the world Amongst great acquisitions are the Turner Collection, which include some 19,000 drawings, the collection of Sir Robert Peel, and the various pictures bought by the National Art Collections Fund, which include the Velazquez "Venus" and Holbein's "Duchess of Milan"

A NATIONAL GALLERY TREASURE
One of the most beautiful portraits in the world, this painting by Holbein, done in 1538, of Christina of Denmark, Duchess of Milan, shows her as a girl-widow It was purchased for the National Gallery, London, in 1909

Besides these two galleries, there is, in a building adjoining the National Gallery, the National Portrait Gallery

National Mark. In 1928 the Agricultural Produce (Grading and Marking) Act was passed This gave the Minister of Agriculture power to prescribe standards of quality, called grades, for home produce, and to prescribe a mark with which this graded produce could be identified In order to make buying easy, one mark, the National Mark, which is a trade mark registered on behalf of the Minister of Agriculture, is being used for all graded produce of England and Wales

NATIONAL MARK
This is the National Mark, bearing the words "Produce of England and Wales," which is affixed to foodstuffs of good quality grown in these countries

Since the passing of the Act, provision has been made for the grading of a number of the principal products of our farms and orchards, and for their sale under the National Mark These include beef (in London, Birmingham, Liverpool, Leeds, Bradford, and Halifax only), eggs, table poultry, all the fresh fruits and vegetables of commercial significance, canned and bottled fruits and vegetables, honey, cider, perry (a drink like cider made from pears), flour, malt flour and malt extract, wheat flakes, cheese, butter, and fruit products

So next time you go shopping insist upon seeing the National Mark on the goods you buy, by doing so, you can be sure of their quality and know that you are not being overcharged

National Songs. Every country has a national hymn, and this is as often as not an old folksong that has grown with the nation and expresses in melody and words the soul of the people whose love has made it their patriotic song

The national song whose air has been used more widely than any other is "God Save the King," the national anthem of Great Britain, variously assigned to Dr John Bull (1563–1628) and to Henry Carey (died 1743), it first became popular in 1745 as a musical protest against the Jacobites Both words and music have doubtless evolved from earlier forms The melody, with various appropriate words, has been adopted by Germany, Denmark, Switzerland, and the United States Another famous British national song is "Rule Britannia!"

Among the national songs of the Dominions of the British Empire are 'The Maple Leaf For-

THE FRENCH NATIONAL SONG SUNG FOR THE FIRST TIME

The "Marseillaise," the stirring battle song of the Revolution, later adopted as the French national anthem, was written and composed by the young soldier Rouget de Lisle In this picture we see him singing it for the first time in public—to a group of his friends who are listening with rapt attention to the moving words and thrilling tune

From the painting by Isidore Pils in the Louvre photo Mansell

The former Austrian Empire had a dignified and inspiring national hymn, "God Preserve the Emperor," the music of which was written by Joseph Haydn Before the great upheaval of the World War Germany's rich store of national songs supplied her people with music for all occasions Of these "Deutschland uber Alles" ("Germany over All") and "Die Wacht am Rhein" ("The Watch on the Rhine") were popular expressions of patriotism The new Nazi hymn is the stirring "Horst Wessel" song

Ever" of Canada, words and music by A Muir, and "The Song of Australia," words by Mrs Carleton, music by Singer Other outstanding songs of the British Isles are the Irish "Wearing o' the Green," the Scots "Scots wha Hae," and the Welsh "Men of Harlech"

The "Marseillaise" of France dates from the memorable year 1792 (*See* Lisle, Rouget de) The words of the American "Star-Spangled Banner" were written by Francis Scott Key during the British bombardment of Fort MacHenry in 1812 Perhaps the "Battle Hymn of the Republic" more nearly approaches the status of a national song

Belgium has the stirring "Brabançonne," the music of which, by François van Campenhout, was written during the rising of 1830 To the official Italian "Royal March" has been added the Fascist hymn, "Giovinezza"

All Slavic peoples have a wealth of patriotic folk-music The hymn of old Russia was "God Protect the Tsar," dating from 1830, but today Russians sing the "Internationale"

National Trust. This is the abbreviated form of the name of the National Trust for Places of Historic Interest or Natural Beauty

BEAUTIFUL VALLEY OWNED BY THE NATIONAL TRUST

Founded in order to save our beautiful countryside from exploitation by builders and road makers, and also to throw open to the people regions which, while in private hands, might never be visited, the National Trust now owns a large area of the English landscape This is part of lovely Dovedale, Derbyshire, 30 acres of which were presented to the Trust by Imperial Chemical Industries, Ltd

Courtesy of National Trust

STUDYING NATURE WITH A CAMERA

Timid creatures like the deer come to their drinking places at night This beautiful animal was about to drink at a forest pool when it heard the click of the camera and saw the flashlight It looked up startled and this picture resulted Of course to get pictures like this needs years of patient work and skill in photography but even during the daytime you can watch the deer at close quarters if you stay very still and quiet

GLIMPSES OF THE WATER-RAIL'S HOME LIFE

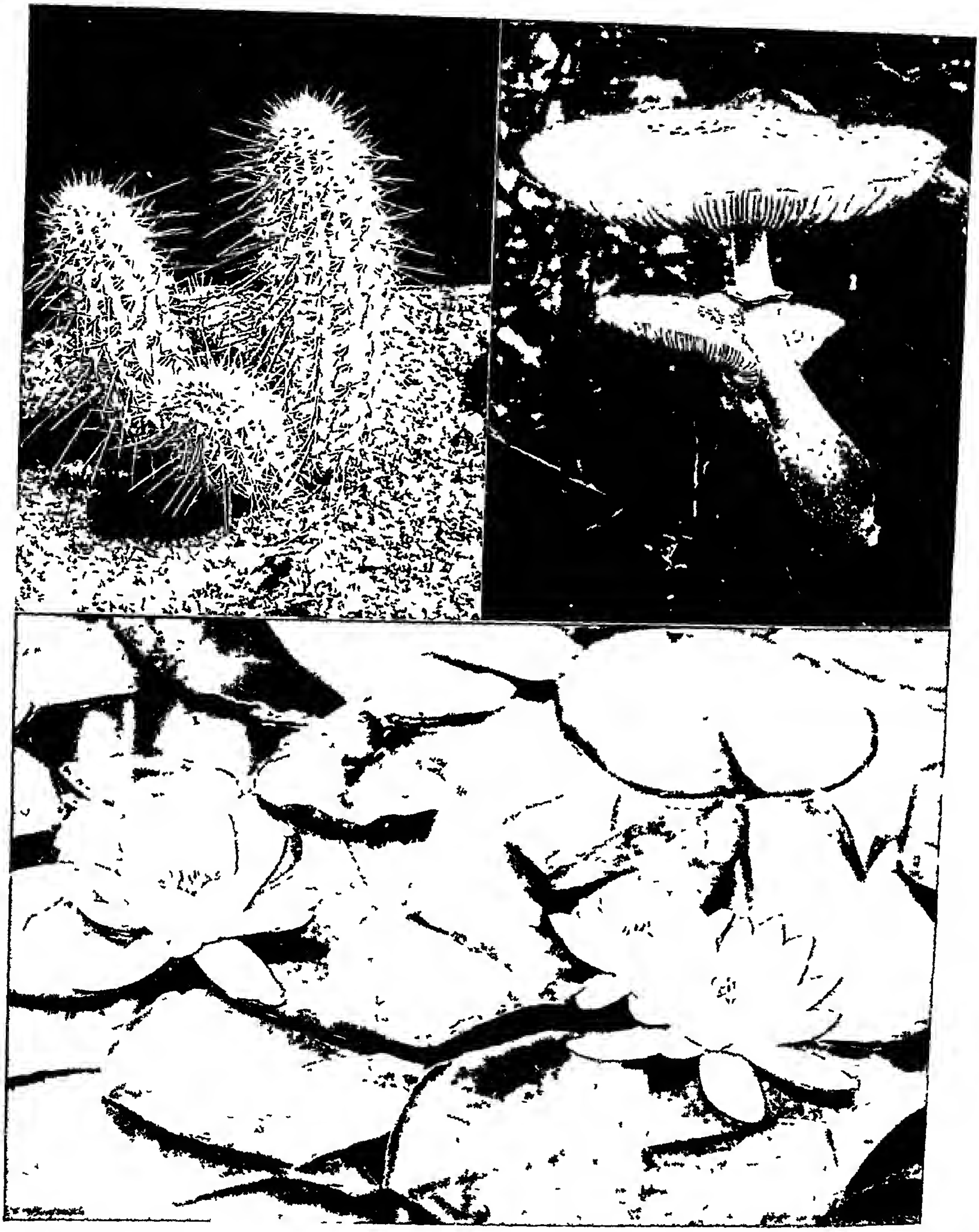
I J Howling

In recent years the field naturalist has been greatly helped by photography, and such series of pictures as this tell us more than we can ever get from a written description The water-rail is one of our shyest birds, but here are intimate glimpses of its home life, the reward of hours of patient watching See how cautiously the bird approaches its nest before settling on the eggs, and how cunningly placed and contrived the nest is

STUDIES OF THE HABITS OF THE WATER-SPIDER

Here are some very remarkable pictures of the water spider one of the most attractive inhabitants of the stream or pond You can see just such scenes as these yourself if you have a small aquarium in a glass tank, though you will need a good deal of specialized skill to photograph them This spider makes a nest of web, which it fills with air-bubbles and it then lays its eggs inside As you see, it is itself covered with a film of air, held in the hairs covering its body

PLANTS CLING TO LIFE IN ALL CONDITIONS



Here are three types of plants that live under the *most trying conditions* The cactus (upper left) with its thick, water-saving shape, thrives in the dry desert The fungus (upper right) lacks the green colouring substance with which other plants are able to manufacture their own food So it has to live as a parasite on the bark of an old tree stump The water-lily (below) makes its home in pools, sending its leaves and blossoms to the surface Notice how the flat leaves support the flowers

Founded in 1895, it has been steadily purchasing ancient buildings, open spaces, and tracts of land in all parts of England and Wales, so that they may be preserved for ever, a heritage for the people of Britain Amongst famous places preserved in this manner by the Trust are Box Hill, in Surrey, Wicken Fen, Cambridgeshire, much land in the Lake District, Stonehenge, land in Devon and on Exmoor, and many fine old houses in all parts of the country

The total area now owned and controlled by the National Trust is approximately 60,000 acres There is a separate Trust for Scotland

Natural History Societies. Several organizations deal with Natural History all over Britain, such as the British Empire Naturalists' Association, which publishes also a quarterly paper called "The Countryside", and there are special societies which deal with only one branch of Nature study, such as the Royal Entomological Society, which is interested only in insects, and Flora's League, concerned with the preservation of wild flowers

Besides these, there are innumerable local Natural History societies, such, for example, as those belonging to the various counties, most of these have a "field club," and this is usually combined with an archaeological club These bodies run excursions to notable places, or to study the Natural History of especial districts, in most cases a subscription is necessary, and this usually entitles one to receive the annual report The reports of many of these societies, indeed, constitute their most permanent value, for in them often appear for the first time observations, papers, or lectures which may have untold importance in later years Many a great discovery in Natural History has first been announced in the pages of some slim annual "proceedings" of a provincial Natural History club Another consideration is that these bodies usually compile lists of the first appearances of birds, flowers, or insects every year, of rare species seen or discovered in the district, of weather, and of other annual phenomena

TURNING *the* PAGES *of* NATURE'S BOOK

For town dwellers Nature study is a passport to a new and enchanted world, the fascination of which increases as more is learnt about it Nature is, indeed, full of lovely pictures and thrilling stories

Nature Study. If you were lost in the woods in the daytime could you find the north? Which birds in your neighbourhood stay throughout the winter and which go south? Do you know when each winter absentee gets back in the spring? When do the first houseflies appear, and where do they come from? When do the horses and other farm animals begin to shed their winter coats? Are potato roots above or below the tubers? What does a clover leaf do every night? Does a wood sorrel, which has a similar leaf, do the same thing? Why are the pebbles in the bed of the brook all rounded? Have you seen rounded pebbles anywhere else? What do they tell you?

One misses a tremendous amount of the fun of living in this remarkably interesting world if one goes through it blind to the curious and beautiful sights spread out before one's eyes, and deaf to the thousand-and-one fascinating stories told by every leaf and pebble and feather Too many of us go through life like this We look at things just enough to make sure that we fasten the right names to them—that we do not call a cat a dog—and there we stop

In certain orchards the blossoms on some of the branches of the apple trees withered and died, while the blossoms of other branches produced fruit The farmers consulted an agricultural

F G M Westropp

NATURALISTS IN THE FIELD

The great value of Nature study is that it is not a specialized science, anyone can wander into the countryside and see for himself what Nature is and does Yet specialists enjoy it just as much, like these butterfly collectors on a Surrey common

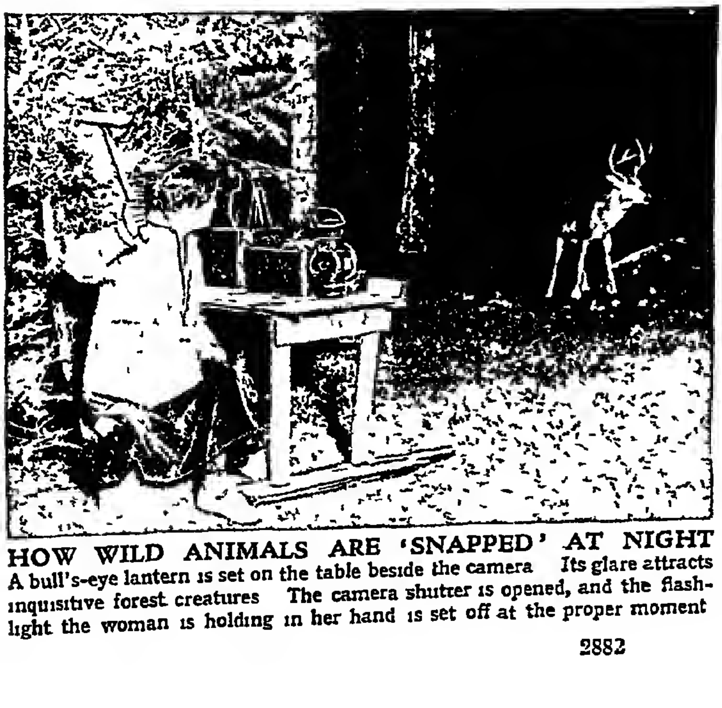
A CAMERA CAPTURE

Have you ever tried "hunting" with a camera? If you want to get close to the great out-of-doors, the camera will give you all the thrills of shooting, and a lasting record of every pleasure as well As a pastime, picture-hunting is unexcelled

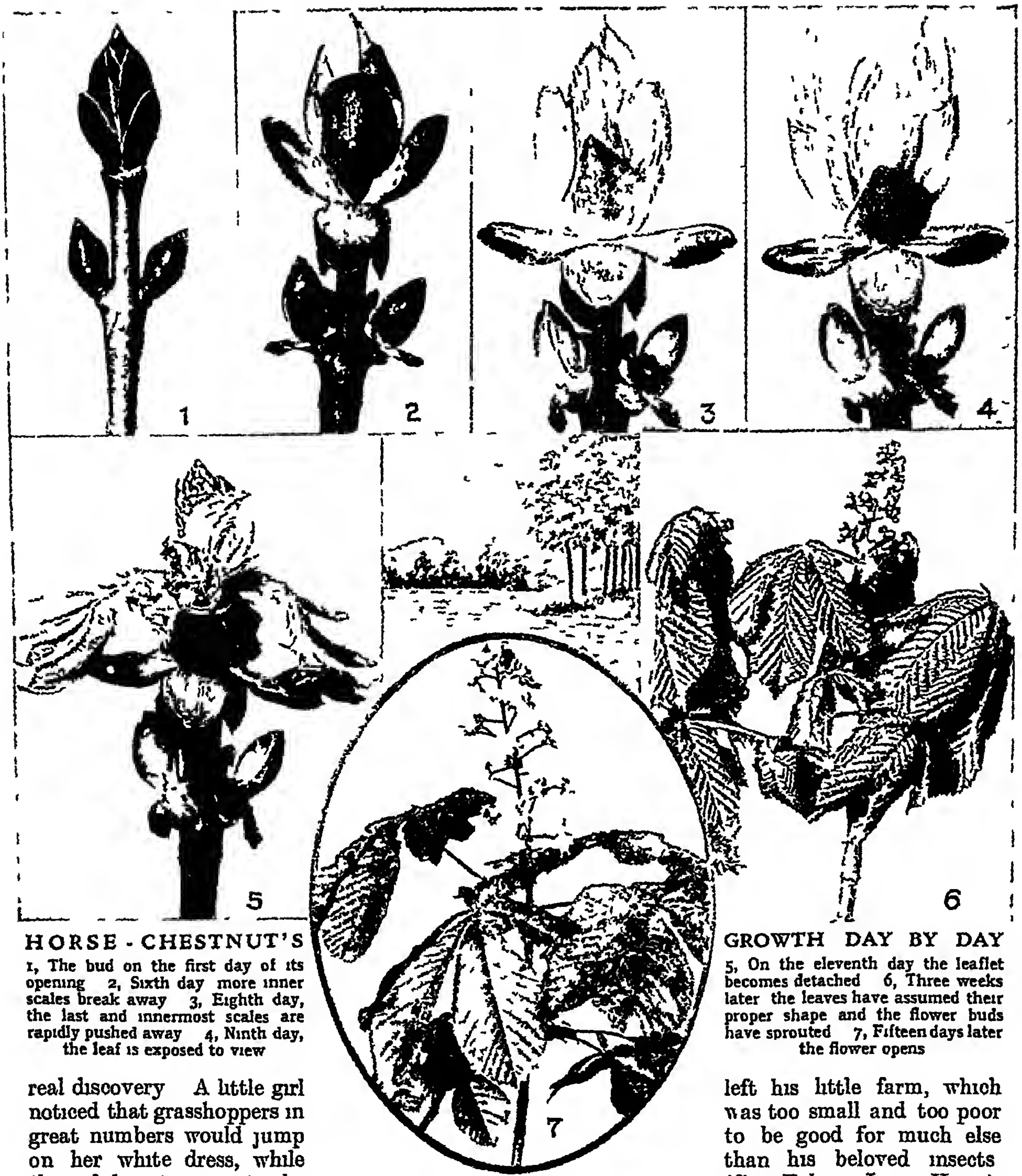
expert to find out what the matter was and what could be done about it The expert asked what the withered flowers looked like and what could be seen on the branches What were the symptoms? Nobody had thought to look! But, asked the expert, hadn't they seen the affected limbs? Oh, yes, said the farmers, they had seen them—from the farm-yard!

Does such unobservant heedlessness seem absurd? But how many of us show a greater degree of intelligent curiosity in regard to "common things"? Don't we take a day off to go to the zoo or the menagerie, and gape at the lion and the hippopotamus, without realizing that we have at home in the pet kitten a specimen of the genus *Felis* which is just as interesting as a lion or a tiger, and that on any August day we can pick up from the field a far more grotesque creature than the hippopotamus—a grasshopper? When we exclaim in delight at a picture of a bamboo jungle in Borneo, do we realize that there is just as wild and beautiful a jungle in the grass-grown fence corner? Perhaps we think we know all about cats, grasshoppers, and grass Do you know how many toes a cat has on each foot, or how a newly hatched grasshopper differs from a full-grown one? Nature study is just keeping one's eyes, ears, and mind open to the sights and sounds, the facts and the fascinating puzzles of the natural world Anyone who lives in the country is fortunately placed for such study But there are few places from which Nature is entirely shut out, and wherever winds blow, sun and stars shine, snow and rain fall, weeds grow, and flies and wasps buzz, there are the materials for studying Nature

Microscopes, field-glasses, and other tools of science are helpful things, but anyone with two good eyes and really intelligent curiosity about the world may be fortunate enough to make a



HOW WILD ANIMALS ARE 'SNAPPED' AT NIGHT
A bull's-eye lantern is set on the table beside the camera Its glare attracts inquisitive forest creatures The camera shutter is opened, and the flash-light the woman is holding in her hand is set off at the proper moment



HORSE - CHESTNUT'S GROWTH DAY BY DAY

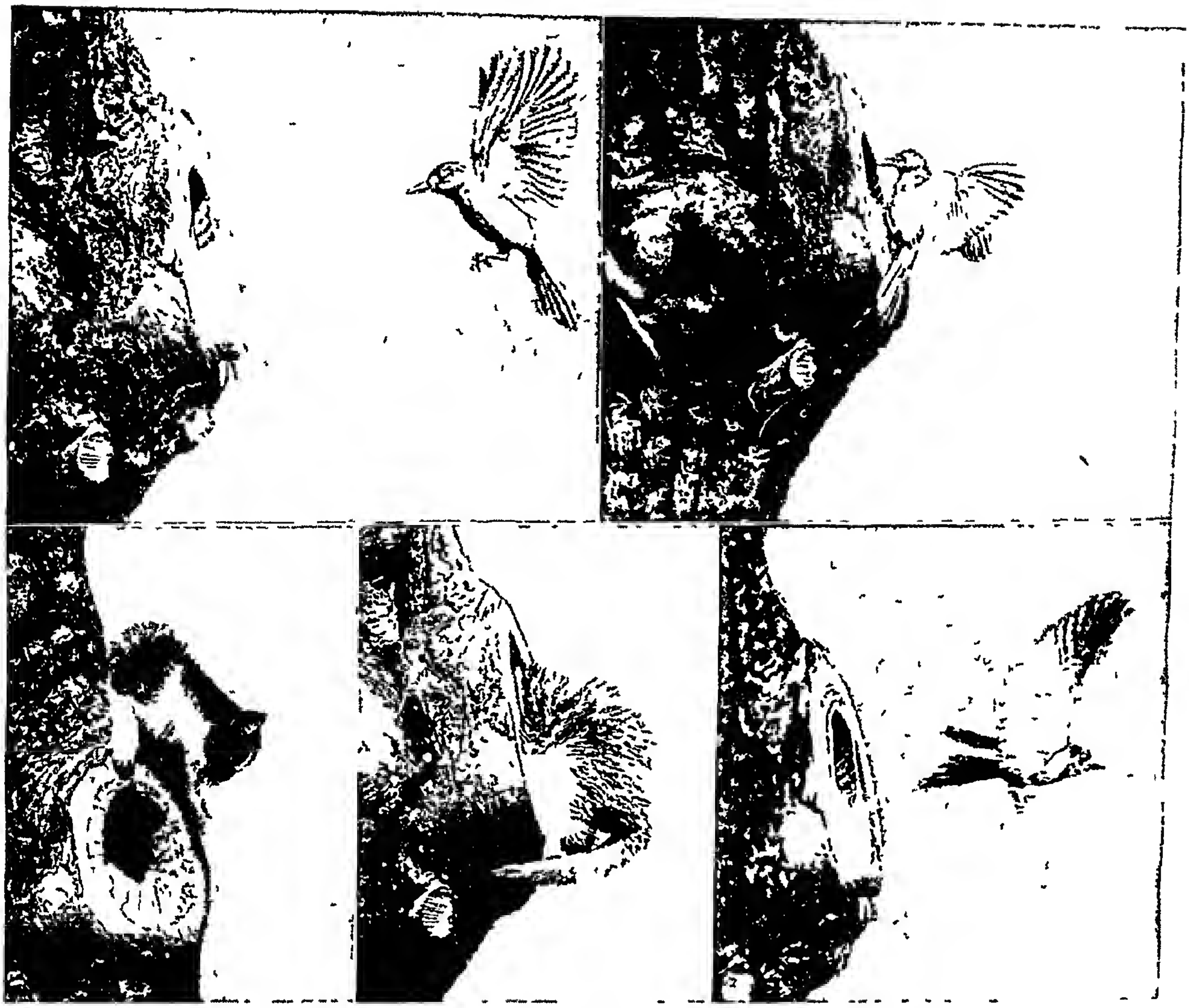
1, The bud on the first day of its opening 2, Sixth day more inner scales break away 3, Eighth day, the last and innermost scales are rapidly pushed away 4, Ninth day, the leaf is exposed to view 5, On the eleventh day the leaflet becomes detached 6, Three weeks later the leaves have assumed their proper shape and the flower buds have sprouted 7, Fifteen days later the flower opens

real discovery A little girl noticed that grasshoppers in great numbers would jump on her white dress, while they did not seem to be attracted by her coloured dresses She asked her teacher why grasshoppers like white He did not know, and sent the query on to an eminent entomologist, who replied that he had never known that grasshoppers showed such preference, and that the little girl had made an important observation, which would have to be followed up

One need not stir from home to find opportunities for studying Nature The great French naturalist Fabre, who made the stories of the ants, the bees, the wasps, and the beetles more interesting than most novels, for 30 years never left his little farm, which was too small and too poor to be good for much else than his beloved insects (*See* Fabre, Jean Henri)

Books are helpful, and some " Nature books " are among the most delightful contributions to literature Anyone who becomes deeply interested in any phase of Nature will want to know what has been written about it But the real text-book is Nature herself

You will find it not only interesting at the time, but well worth while later on, to keep a diary of Nature happenings If you become especially interested in birds or butterflies or flowers or ferns, or anything else, you will want to " camp on the trail " of the creature or plant until you have learned all you can about it,



THE STORY OF THE CAT AND THE FLYCATCHER

Little mother flycatcher had moved in where a woodpecker had moved out, had made her nest in the cosy hollow of the tree, after the manner of her people, and had hatched her little brood Along came the cat, climbing right up to the nest, although it was six feet above the ground, and poked in her head with the idea of eating the little flycatchers But mother was on the nest and she pecked at that cat's eyes with her bill, and beat it in the face with her wings, so that it backed out as fast as it could and went scampering down the tree Then little mother flycatcher started out to get something for the family supper

and wherever you go, a notebook will prove invaluable

It is never too soon, never too late, to start your note-book or Nature diary Let us suppose you begin just when your summer holidays are over and Nature seems to be " shutting up shop " for the autumn and winter

In September or October there are still plenty of features of plant life which need examining the more common autumn fruits of the locality, wild and cultivated, with a study of their form, texture, flavour, name, and use, the autumn leaves and flowers, the seeds, their forms, methods of distribution and adaptations thereto The animal life of these months is full of interest for young and old The birds which have summered in the locality are going south and others with strange plumage are coming from the north on their way farther south or to spend the winter here Insects are gradually disappearing in a variety of ways, some going into winter quarters to appear in new forms in the spring, others hiding away in the trees, in the earth, or elsewhere, while countless multitudes deposit their eggs and die The thickening of the coats of the wild and domestic animals can be observed now and in the month following Clouds, rain, dew, frost, temperature, direction of the wind, change with every month in the year

In November and December the student of Nature tries to discover how the plants have prepared for winter, how the buds are sealed up, where the leaves have gone, what animals still remain in the locality and how they live, what the streams are doing, where the fish and other water animals have gone, what the farmers are doing These are good months for studying further any collections of fruits, seeds, leaves, and grasses made in other months—though you

HAPPY HUNTING-GROUND OF THE NATURALIST

The Nature student is particularly fortunate in his choice of a hobby, because it leads him into so many delightful places In this lovely woodland glade for instance where the stately foxgloves rear their spires of pink blossoms above the surrounding growth the naturalist may find subjects of interest to keep him (or her) occupied for hours 'Foxglove, by the way is said to mean the glove of the fairies or good folk it has nothing to do with foxes Other names for the flower are fairy-bells elf-gloves fairy fingers and fairy petticoats

Photo Robert M Adam

should try to avoid wildly making collections which have no useful purpose

The weather is an all too obvious theme from January to March, but there is much also to engage attention on the lines mentioned for the preceding months You can note the swelling and opening of certain kinds of buds, the flowing of the sap in the trees, the occasional appearance of animals, the buzzing of venturesome bees Some things, such as trees, are as well studied now as at any time, for you can learn to distinguish each one in its winter bareness, by the manner of growth, the form of branching, the general appearance of the boughs and bole There are, too, all the winter visitors among the birds, and you may see your own residents better by feeding them with bones, nuts, meat, or fat on a string

April, May, and June conspire to furnish almost too much material to attract and interest childhood, and after a bit you must try to decide just which subjects you now want to study most—flowers, insects, trees, birds, etc You can watch, day by day, the unfolding of leaves, the opening of the flowers, the moulting of the birds and the dates on which each sort is first heard singing, the change in form of the grasshopper, the butterfly, the frog, the building of nests, the swarming of the bees

Though they are holiday months, July and August also will provide many experiences, especially if this is your one chance of visiting the seaside

If you are lucky enough to possess a camera you will find "camera hunting" one of the most fascinating of pursuits

This use of the camera has proved of distinct value in aid of Nature study, providing the means of gaining a clear and intimate knowledge of wild animals, birds, and reptiles, their appearance, their haunts, their habits, and all the phases and conditions of their life

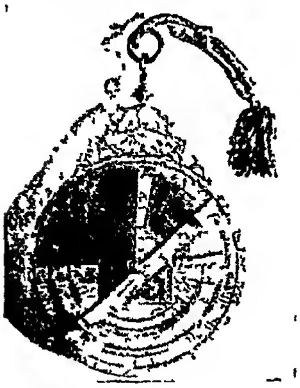
Schoolboys and girls have become expert in securing photographs of the more familiar birds and animals to be found in field and forest accessible to every village and town Stalking a bird, a rabbit, or a squirrel is an experience full of interest You will come to note in what surroundings the bird or animal is found, what it is doing, if feeding, what sort of food it is eating, the place and character of its nest or burrow, and other interesting details

Other branches of Nature study are described under Biology, Ecology, etc

The ART *of* STEERING SHIPS *at* SEA

Since the earliest voyagers first ventured from the coast in their tiny boats, the art of navigation has been studied and improved First the only guide was the stars, but now a whole array of instruments is used

Navigation. Since the dawn of civilization men have been sailing in ships The Phoenicians, Greeks, and Egyptians were the first mariners More than 6,000 years ago stone was being transported by water from the Sinai quarries to Babylonia and Egypt, later, the famous cedars of Lebanon were floated by sea to Jaffa and from there were hauled overland for the building of King Solomon's temple At the same time (1000 B C) the Phoenicians who furnished these cedars commanded the sea from their thriving commercial cities of Tyre and Sidon Their ships were to be found from the "Tin Islands" (the Scillies) off the coast of Britain in the north to as far south perhaps as Sierra Leone



An astrolabe of 1680

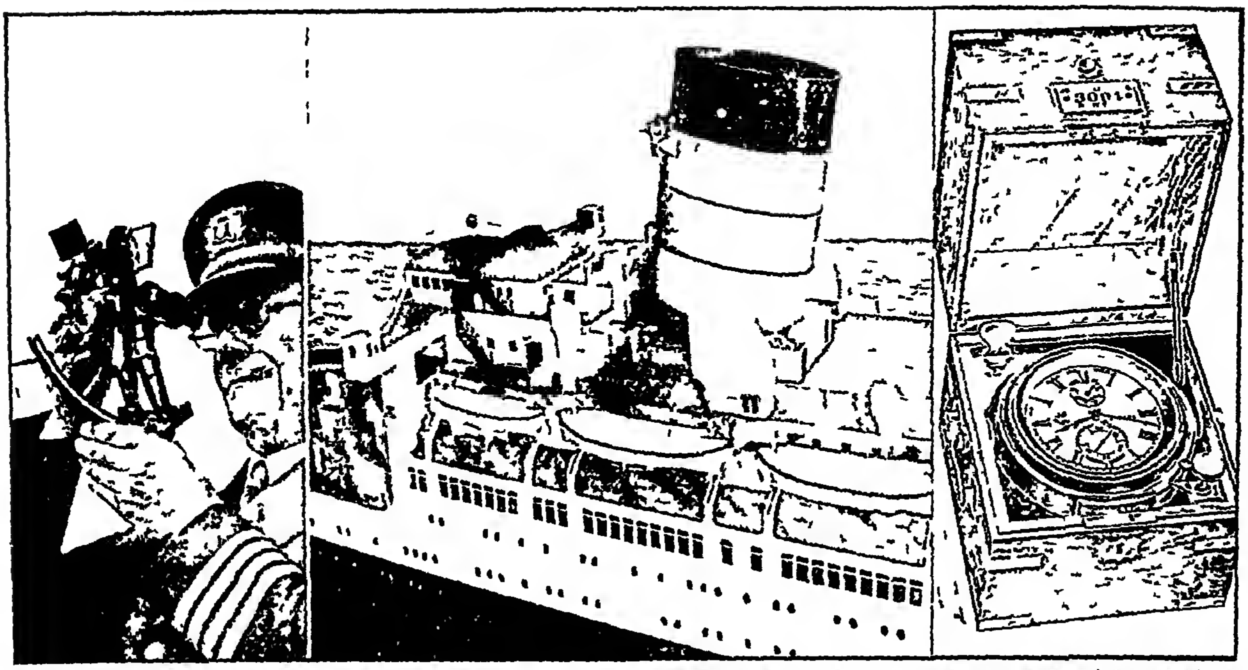
The Nile, the Tigris, and the Euphrates were crowded with boats, and about this time the ports now known as Cadiz, Marseilles, Athens, Jaffa, and many others, were established

In a time when to be a stranger was to be an enemy, it was only natural that men should take to the water to avoid the hazards of travel over country where there were no roads, but perils of all sorts—hostile tribes, swamps, and dangerous animals Terrifying as the sea might be, it was a comparatively safe mode of travel In the inland seas, such as the Mediterranean, sailing consisted mostly of "coasting," that is, of keeping well within the sight of land During the monsoon season, however, a ship might keep its course with fair accuracy by sailing before the exceptionally steady wind

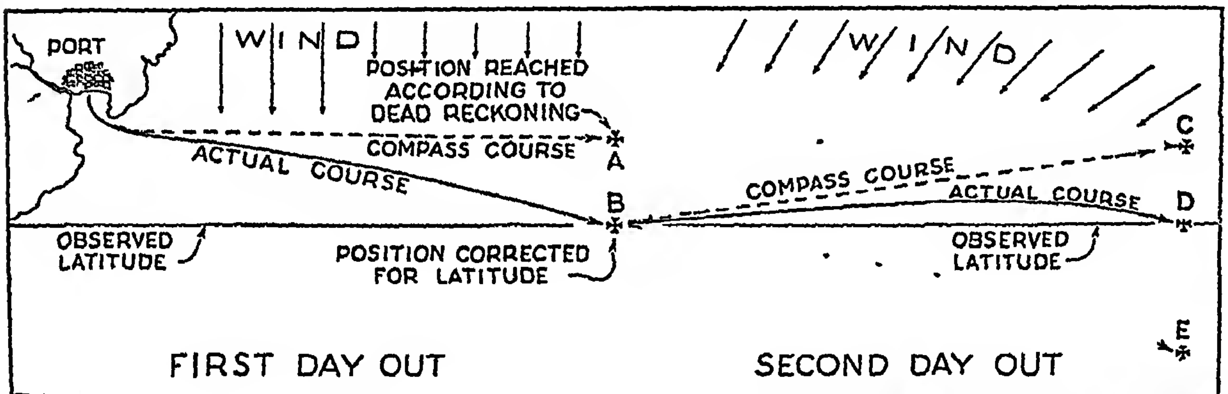
About this time the use of stars as guides began to be understood The pole star, *Polaris*, was the chief stand-by of sailors at night, and later still a rough approximation of latitude was learned by using the cross-staff and astrolabe

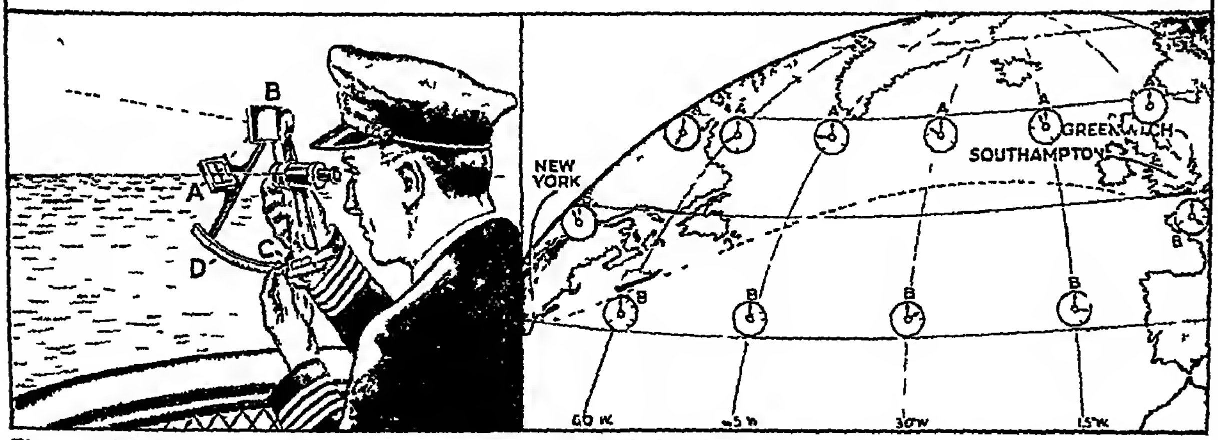
The *cross-staff* worked on this principle A stick, or staff, about a yard long, was fitted with a shorter sliding stick set at right angles to the staff The observer pointed the staff approximately at the half-way point between the horizon and the sun or a star He then moved the cross-bar until the sights at its ends touched the observed body and the horizon A scale of degrees placed along the staff showed the angle, or height, of the observed body Latitude

FINDING THE WAY ACROSS THE OCEAN



The picture in the middle shows the navigating centre of the steamship *Queen Mary* The chartroom and the wheelhouse are on the bridge deck ahead of the funnel Above them is the open signal deck The bridge on each side ends in a shelter or windbreak, which is built out over the water to give a clear view along the ship's side The left-hand picture shows an officer using a sextant, and a chronometer is shown at the right The use of these instruments in setting a ship's course is explained below





The upper diagram illustrates a part of a ship's course in practical navigation The ship leaves port, sailing east toward point C The captain's first latitude observation shows, however, that instead of reaching A, on the true compass course, the ship has been blown off course to B The captain now lays a new course to reach C, but next day finds himself at D instead The error, however, is small whereas if he had not altered his course the day before, the ship would have reached E By such repeated corrections a ship is kept on the desired course At the lower left we see how the sextant is used to determine latitude First, the officer sights on the horizon through the *unsilvered* half of the mirror Second, he moves arm C until the upper mirror, B, which is attached to C, throws an image of the sun upon the *silvered* half of A Third, he reads the altitude of the sun above the horizon as indicated on scale D by the pointer on C From this, the officer computes the latitude
At the lower right we see two examples of how a ship's local time, when compared to Greenwich time, establishes the longitude of a ship's position The row of clocks marked A show the local time every 15 degrees westward when it is noon at Greenwich The row of clocks marked B show an identical comparison when it is 4 o'clock at Greenwich If, for example, it is noon by the sun when the Greenwich chronometer says 4 o'clock then the ship has reached the 60th meridian west

determinations with this instrument were seldom accurate within 100 miles

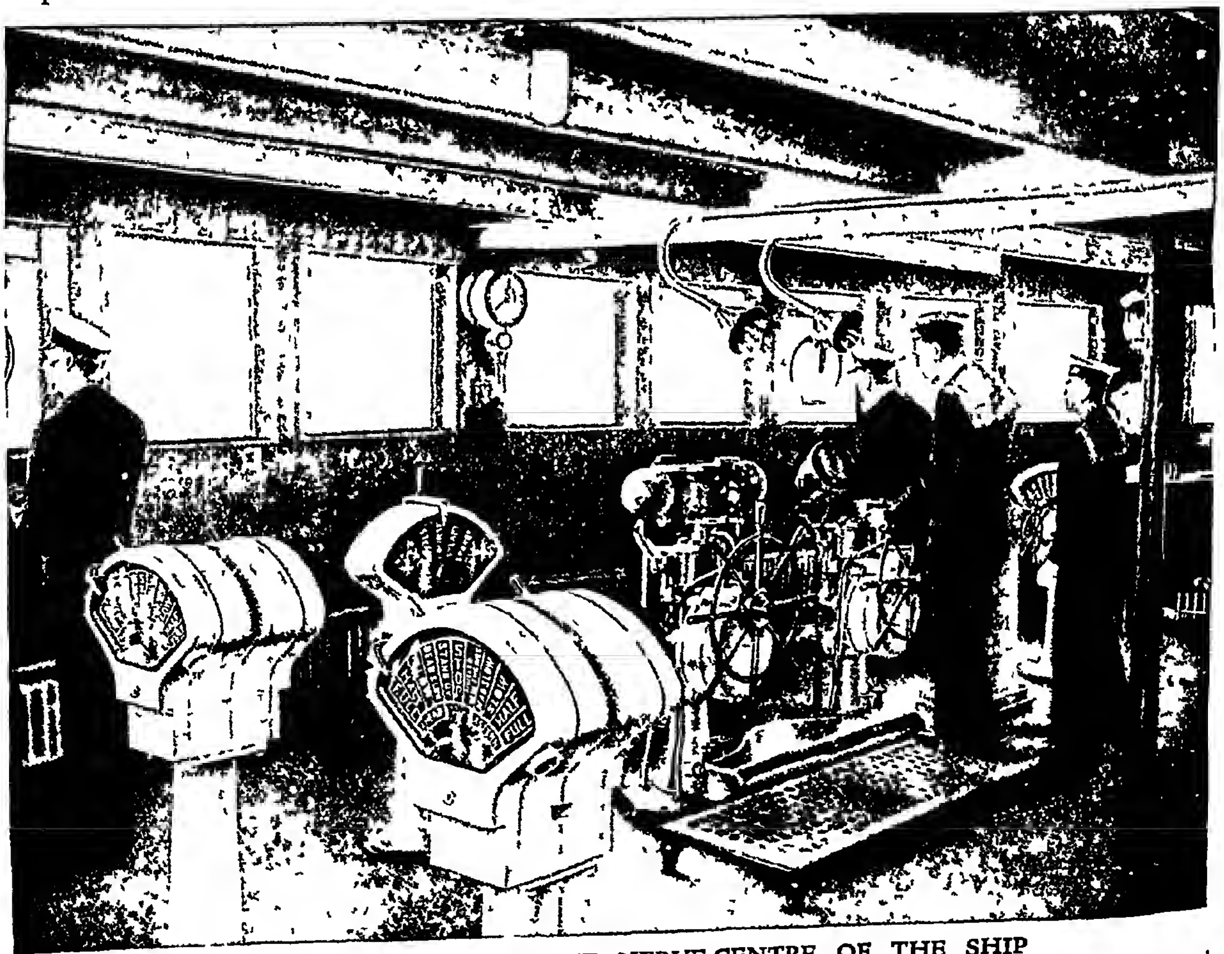
The *astrolabe* was far more accurate in its determination of angles This was a circular plate of brass or bronze, from 4 to 20 inches in diameter A pointer called an *alidade* was pivoted at the centre of the plate One person held the astrolabe vertically by a small ring, while another pointed the alidade at a star or the sun The angle could then be read from degree marks on the plate It permitted not only reasonably accurate fixing of the latitude, but used with an almanac it could determine local time

Columbus carried both the cross-staff and the astrolabe on his great voyages, and could thus keep a fairly accurate record of the latitude He had another instrument, then comparatively new, the magnetic compass, which had found its way westward from the Orient, and had come into general use at sea in the 13th century

The success of Columbus depended on other improvements as well The keeled ship, which could maintain a course in a side or quartering wind without being pushed too much to one side (making " leeway "), was an important contribution So also were the wooden water casks, which could be filled completely and closed with plugs, thus keeping water sweet

Working out a ship's position and setting a new course require long and intricate calculations, even with the aids available today Several methods of sailing are in use, of which the most important is " great circle sailing " This rests on the fact that the shortest distance between any two points on the earth lies along the arc of the " great circle " joining the two points Unless the points are on a common meridian or the Equator, it follows that the true great circle course will not coincide with the compass course You may prove this by stretching a string from widely separated points on a globe, and noting the angle made with the meridians by the cord

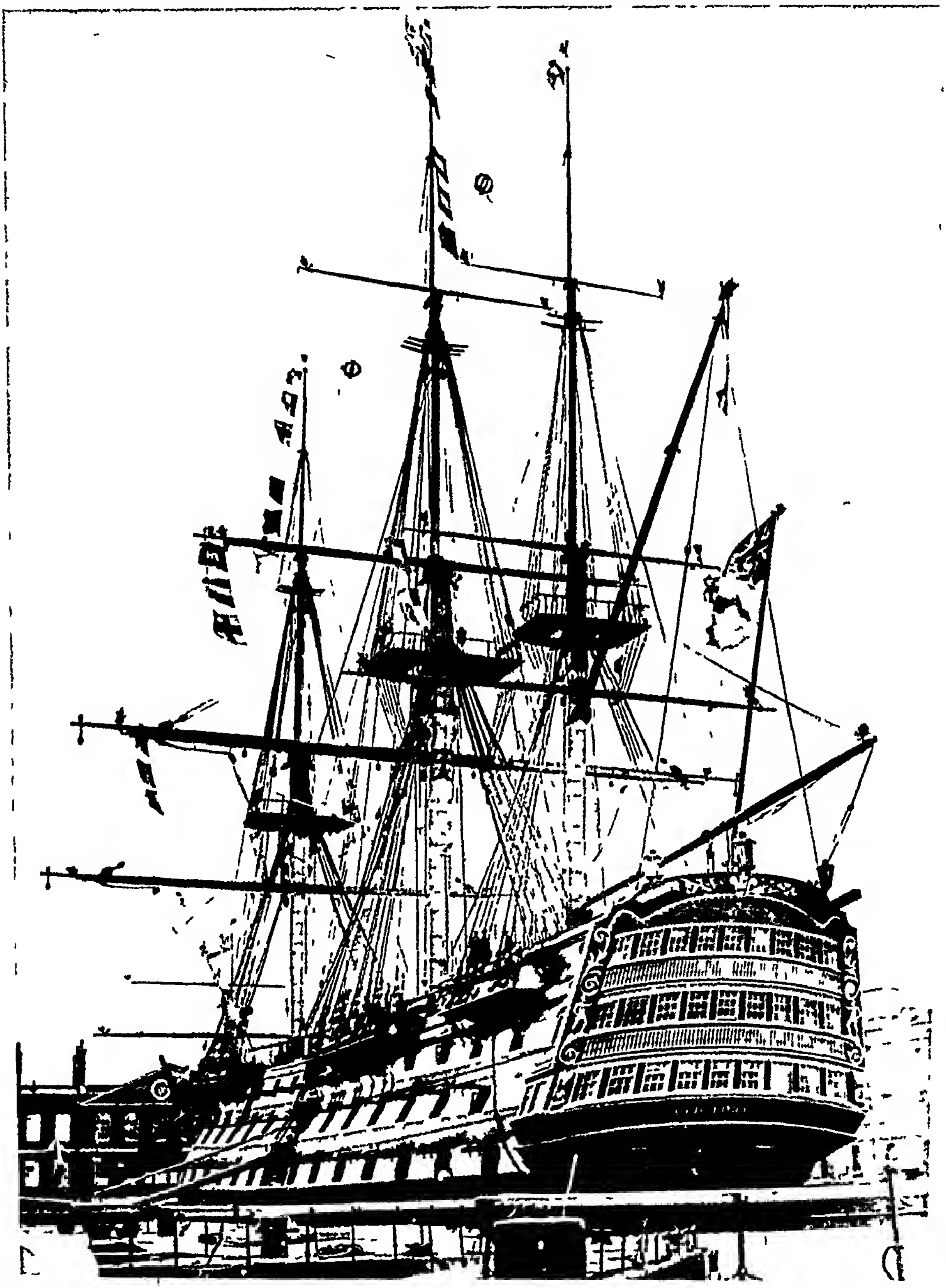
(*See also* Compass, Magnetic, Latitude and Longitude, Lighthouses, Log, Ship's)



NAVIGATING FROM THE NERVE-CENTRE OF THE SHIP

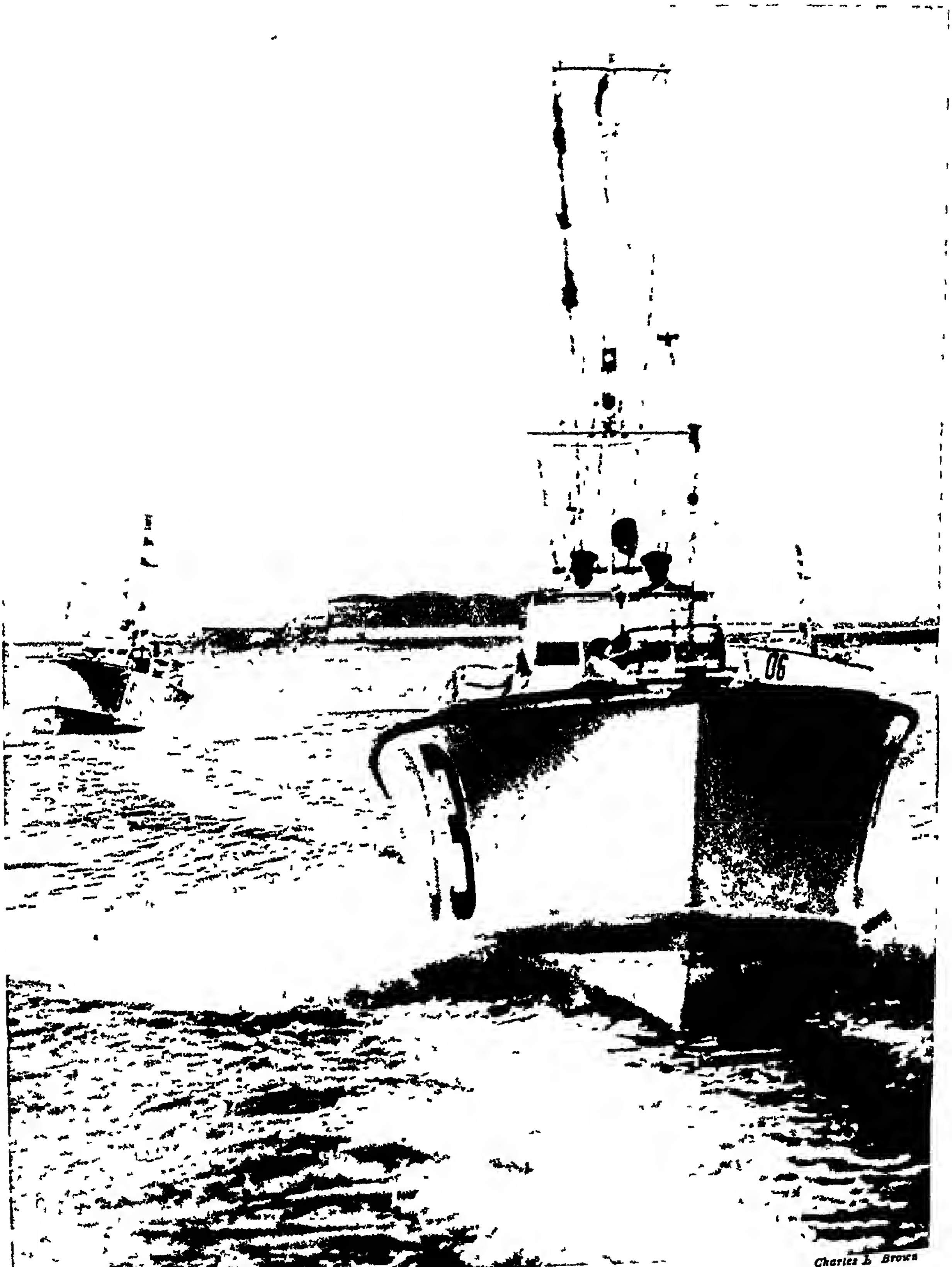
Here we get a glimpse inside the wheelhouse of a great liner just putting out to sea The helmsman, whose official title is quartermaster, stands at the wheel with an emergency wheel at his left In front of him is the magnetic compass To his right is a relief quartermaster, and in front of this man is the gyro-pilot control box with a small wheel for setting it The gyro-pilot will take over the steering once the ship is on its course out in the open sea Beyond the helmsman stands the senior watch officer He is looking *through the "clear-vision window"*—a whirling disk of glass which throws off snow or rain At the extreme left stands the junior watch officer In the immediate foreground are two telegraphs to signal to the engine room, and beyond them a telegraph to the emergency steering room in the stern of the ship Hanging from the ceiling are speaking tubes for communicating with the officers on the bridge and in the engine room On the forward wall is an engine-speed indicator

THE NAVY: 'BRITAIN'S SURE SHIELD'



Nelson's flagship, H M S Victory was afloat in Portsmouth harbour until 1922 when it was found that the condition of her hull was so bad that it was decided to place her permanently in dry dock Since then she has been completely restored, and both hull and rigging are now exactly as they were at the time of the battle of Trafalgar in 1805 This photograph shows the Victory dressed with flags on Trafalgar Day (October 21) with laurel wreaths in honour of Nelson hanging between her masts The Victory is still the flagship of the Commander-in Chief at Portsmouth

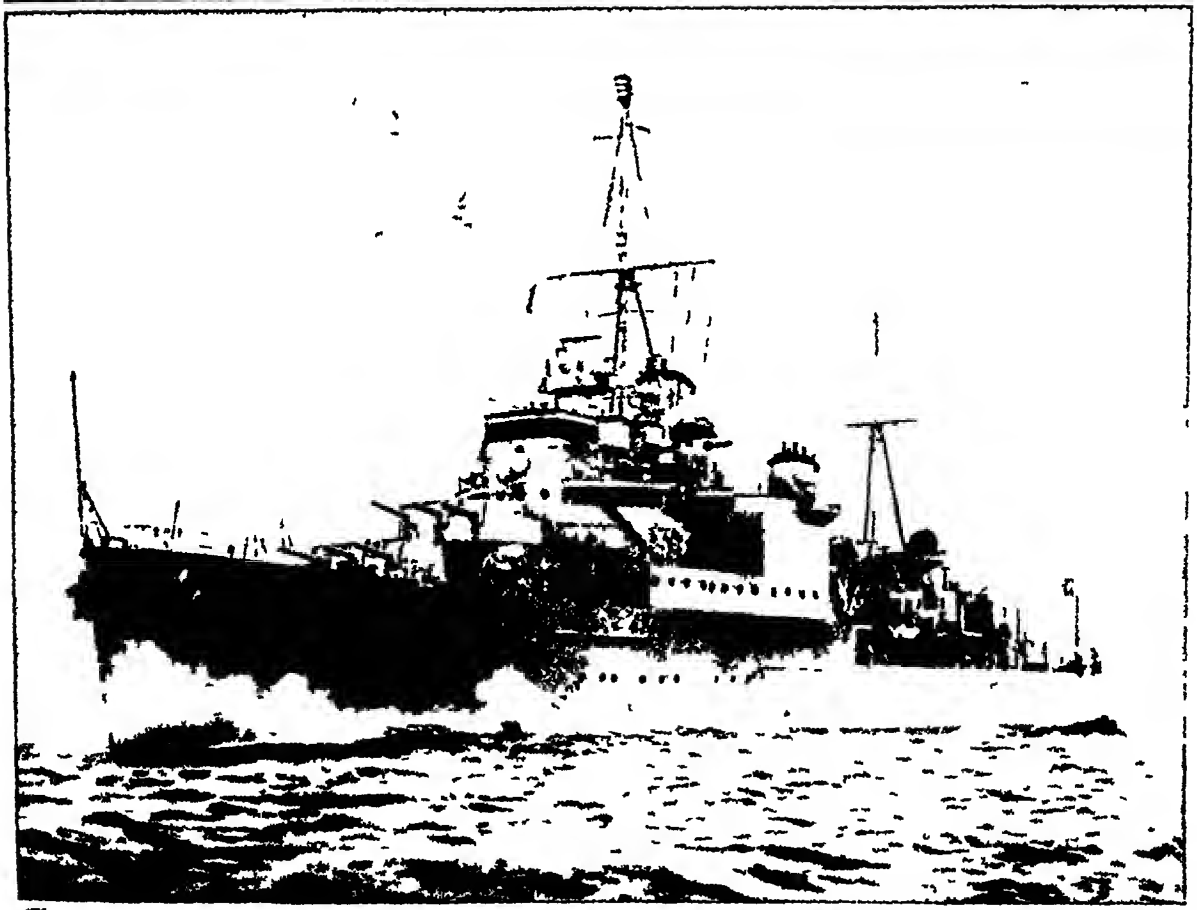
SPEED-BOATS JOIN UP WITH THE ROYAL NAVY



Charles E. Brown

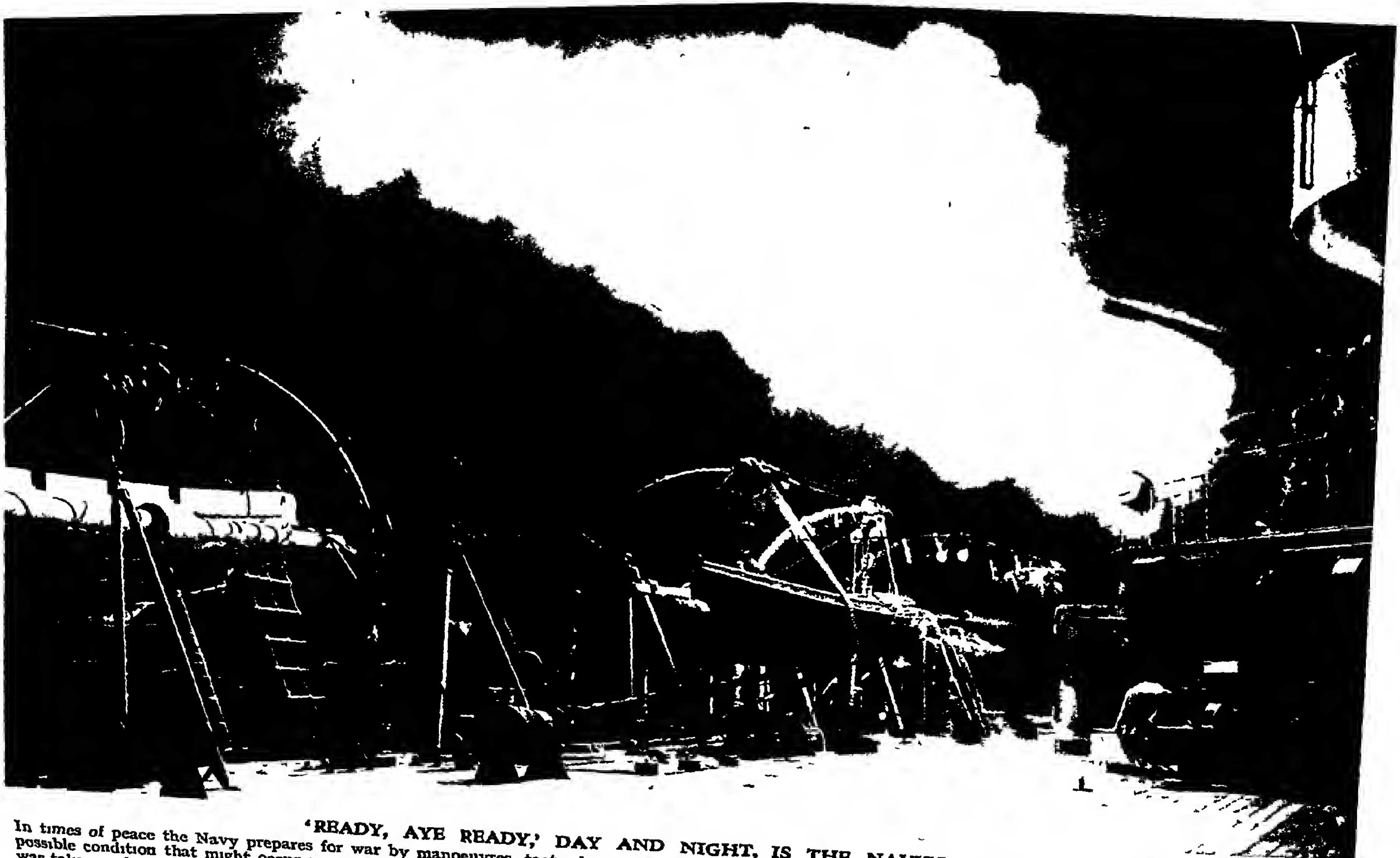
The latest type of vessel in the Royal Navy is the motor torpedo-boat. Twelve of these craft were built between 1936 and 1938. Intended for coastal defence and submarine chasing, they are 60 feet long and have three engines giving 1,500 h.p. and can attain a speed of 35 knots. Their armament consists of eight Lewis guns and two 18 in. torpedo tubes. They carry enough fuel to give them a cruising radius of about 1,500 miles at a speed of 20 knots. Their only superstructure is a wireless aerial.

MODERN TYPES OF BRITISH WARSHIPS



The top photograph shows a British destroyer and the bottom a cruiser The destroyer H M S Intrepid has a length of 323 feet and a beam of 33 feet with a displacement of 1 350 tons Her engines are of 3 400 h p and her speed is 35 knots She carries four 4 7 in guns and has 10 torpedo tubes The cruiser is H M S Southampton, 9,000 tons Her chief armament is eight 6 in guns and she was the first British warship to carry triple turrets Her speed is 32 knots

Photos Beken & Co Wide World

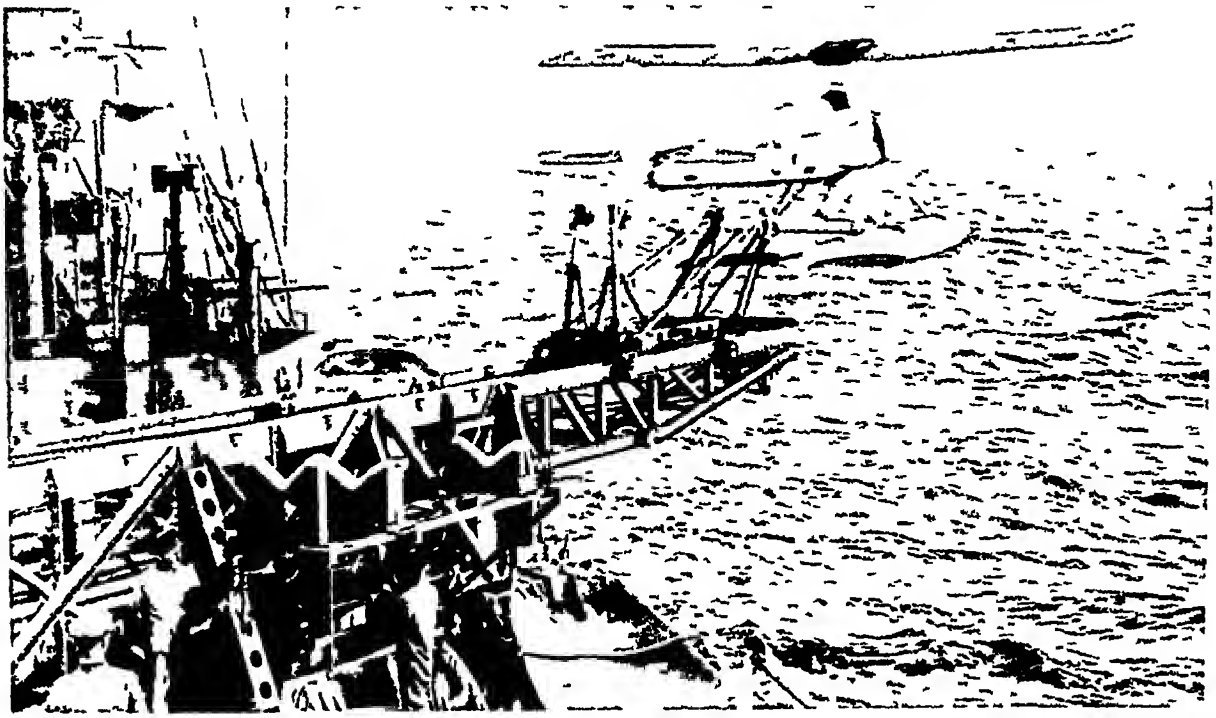


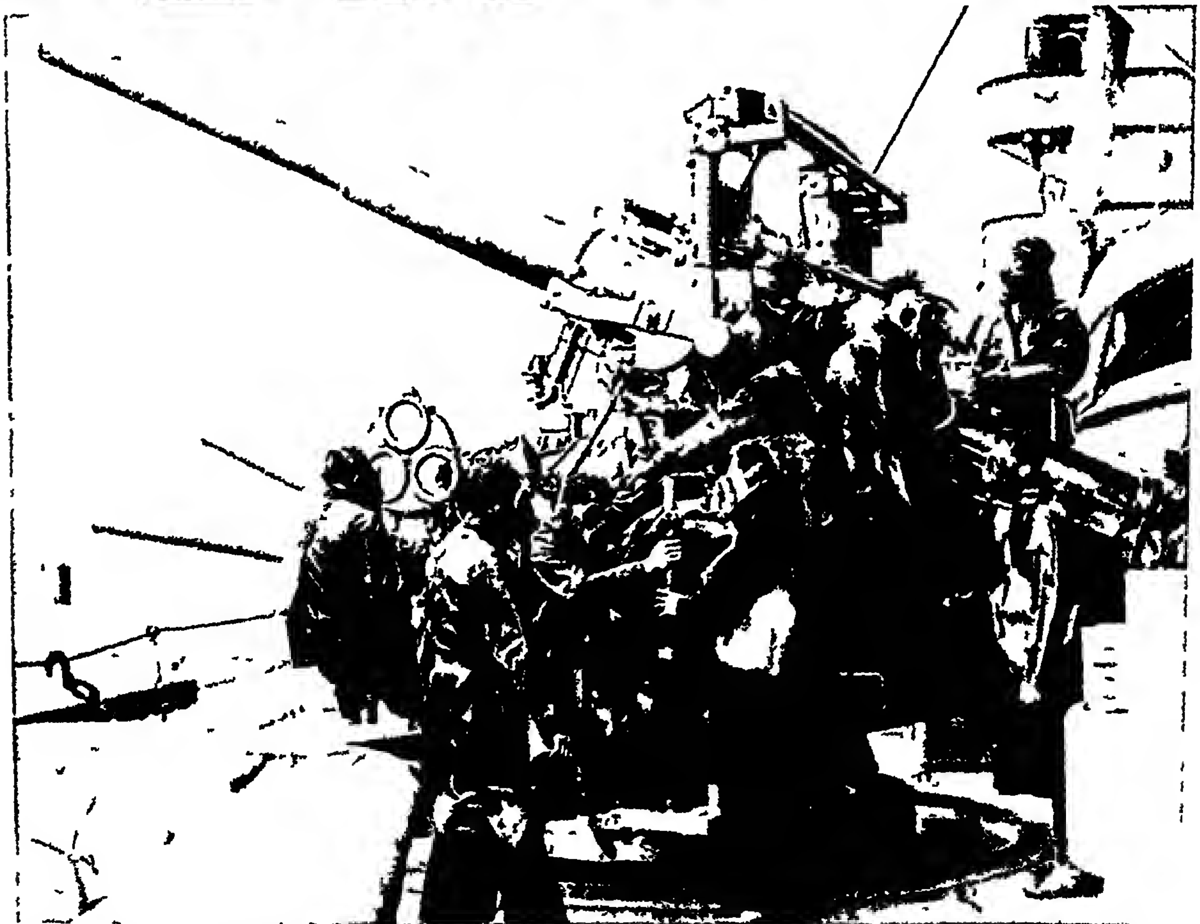
Sport & General

'READY, AYE READY,' DAY AND NIGHT, IS THE NAVY'S MOTTO

In times of peace the Navy prepares for war by manoeuvres tactical exercises and gunnery practice Efforts are made to do the peace-time training in every possible condition that might occur in war-time, and exercises at night with lights out are often *performed* as well as night gunnery practice This photograph was taken on board H M S Rodney during night gunnery practice in the Mediterranean The Rodney is a battleship of 33,900 tons her main armament consisting of nine 16 in guns Here a star shell [illegible]ts up the target is being fired from a 4 7 in gun

NAVAL ANTI-AIRCRAFT GUN AND TARGET PLANE

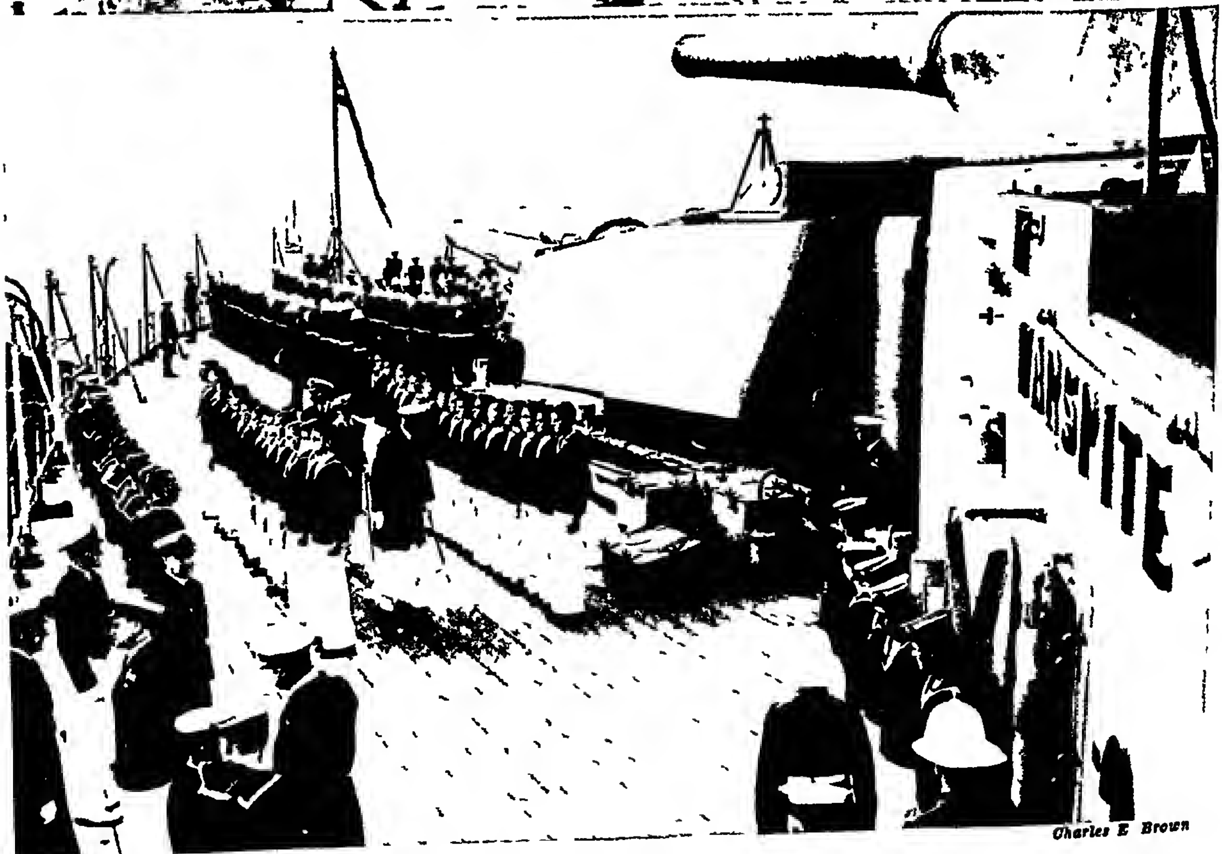




The possibility of attack by aircraft on warships was foreseen some years ago and all naval vessels are now armed with anti-aircraft guns. Before the declaration of war in 1939 naval gun crews were given practice by means of special wireless-controlled target aeroplanes. The top picture shows one of these pilot-less aeroplanes (the "Queen Bee") being launched from the catapult on the cruiser H.M.S. Neptune. Below is the crew of an anti-aircraft gun equipped with gas-masks, engaged in firing practice on board H.M.S. Nelson

Photos: Keystone; Charles E. Brown

LIFE ON THE WORLD'S MOST UP-TO-DATE WARSHIP



Charles E Brown

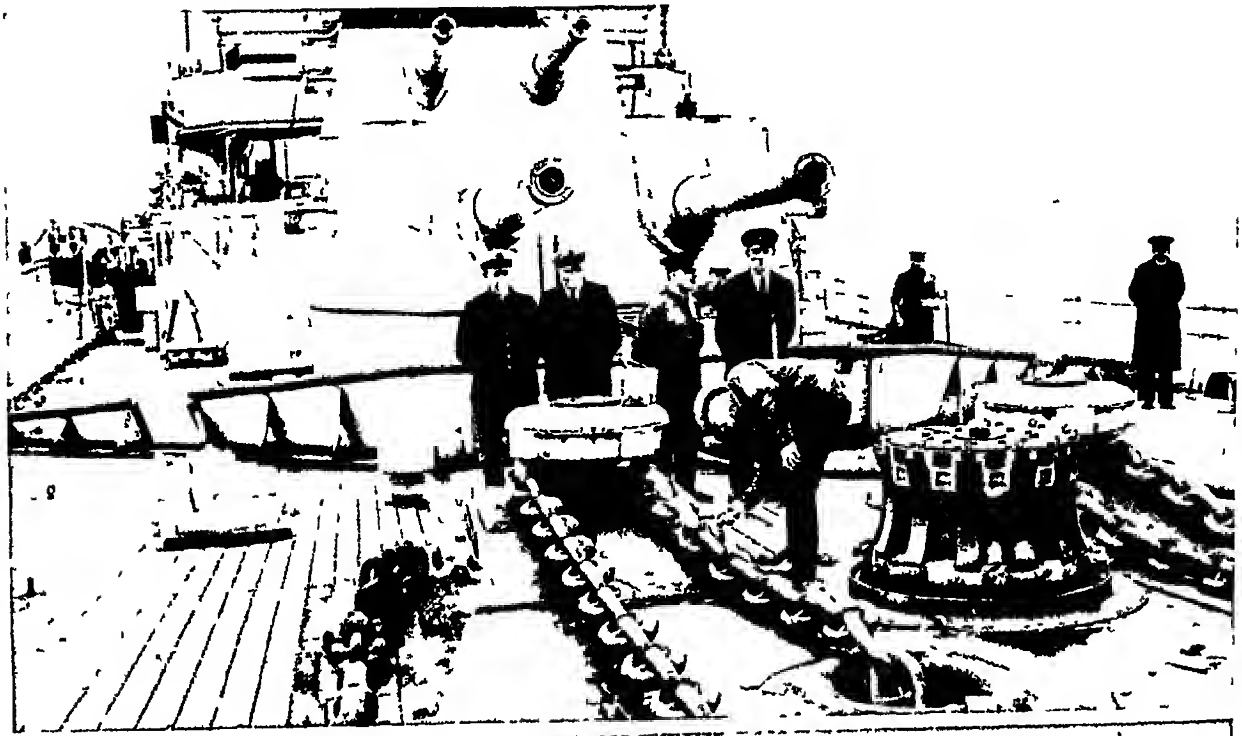
These two scenes are on H M S Warspite, the most up-to-date battleship in the world at the time of her reconstruction Originally launched in 1915, she has been twice rebuilt, finally being re-commissioned during 1937 In the upper photograph ratings are engaged in the early morning deck-cleaning which is part of the routine in every warship, while below, the personnel are being inspected by their captain, Captain F A C Crutchley, V C The white tops to the sailors' caps show that this photograph was taken in the summer

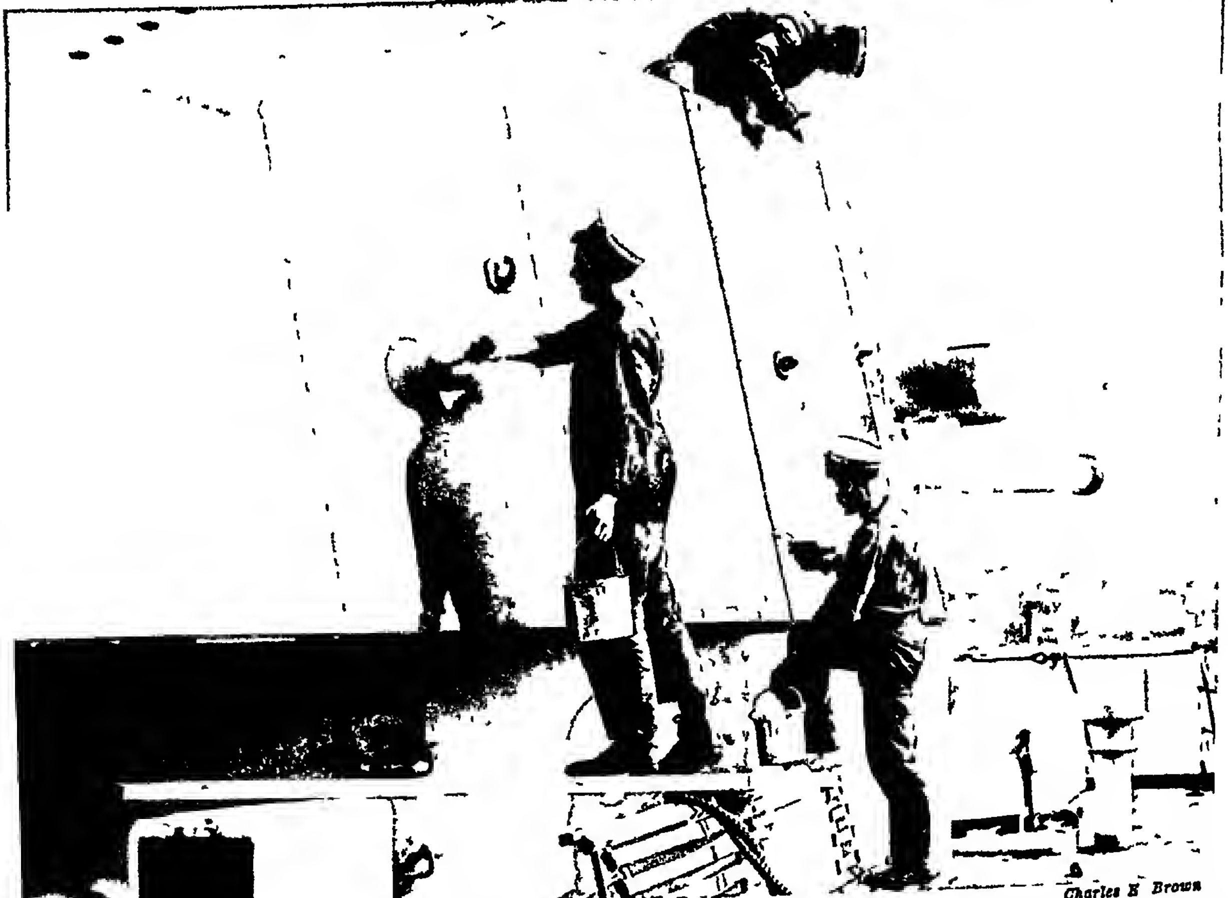
PREPARING A TORPEDO FOR ITS DISCHARGE

Charles E Brown

Here on board a destroyer H M S Verity torpedo practice is in progress and adjustments are being made before the torpedo is launched through the tube the breech of which can be seen behind the petty officer in the centre The stern end of the torpedo is here shown with the propeller which is driven by compressed air In practice no explosive is carried and after the torpedo has been fired it is hauled back on board to be used again The efficient range of a torpedo is between 7,000 to 10 000 yards

ON THE DECK OF A FIRST-CLASS CRUISER





Charles E Brown

These two photographs were taken on board H M S London, a cruiser carrying as her chief armament eight 8 in guns, four of which can be seen in the top photograph In front of the guns a man is painting the shackles which join the lengths of the great chain cable by which the ship is moored or anchored, so as to enable the number of lengths paid out to be counted The lower photograph shows seamen painting red, white, and blue stripes on the turrets of the same ship This was done on ships serving in the Mediterranean during the Spanish Civil War to prevent attacks on them by Spanish aeroplanes unaware of their British nationality

MEN of METTLE in SHIPS of STEEL

Since Alfred the Great first built "the wooden walls of England," the Navy has been the prime defender of our shores and those of the whole Empire—the guardian of home and, in later days, the policeman of the world

Navy. Few people realize the magnitude of the work that is daily accomplished during war-time by the navies of Great Britain and her Allies Land conflicts command more attention partly because more men are engaged, the encounters are more numerous, and casualties are greater Usually sea-power acts with a "noiseless, steady, exhausting pressure, cutting off the resources of the enemy while maintaining its own, supporting wars in scenes where it does not appear itself, or appears only in the background and striking open blows only at rare intervals" And it is in these intervals alone that the wonderful work of the Navy becomes at all spectacular

Nevertheless, the British Navy is a predominant factor in war, exactly as navies have been in nearly every conflict since the Greeks met the Persians at Artemisium and Salamis over 2,000 years ago It has swept German commerce from the seas, blockaded the enemy's coasts, and at the same time protected the transportation of supplies and soldiers for the Allies on every ocean The navy has enabled Britain and her Allies to hold the seas in spite of the havoc wrought by the German submarines

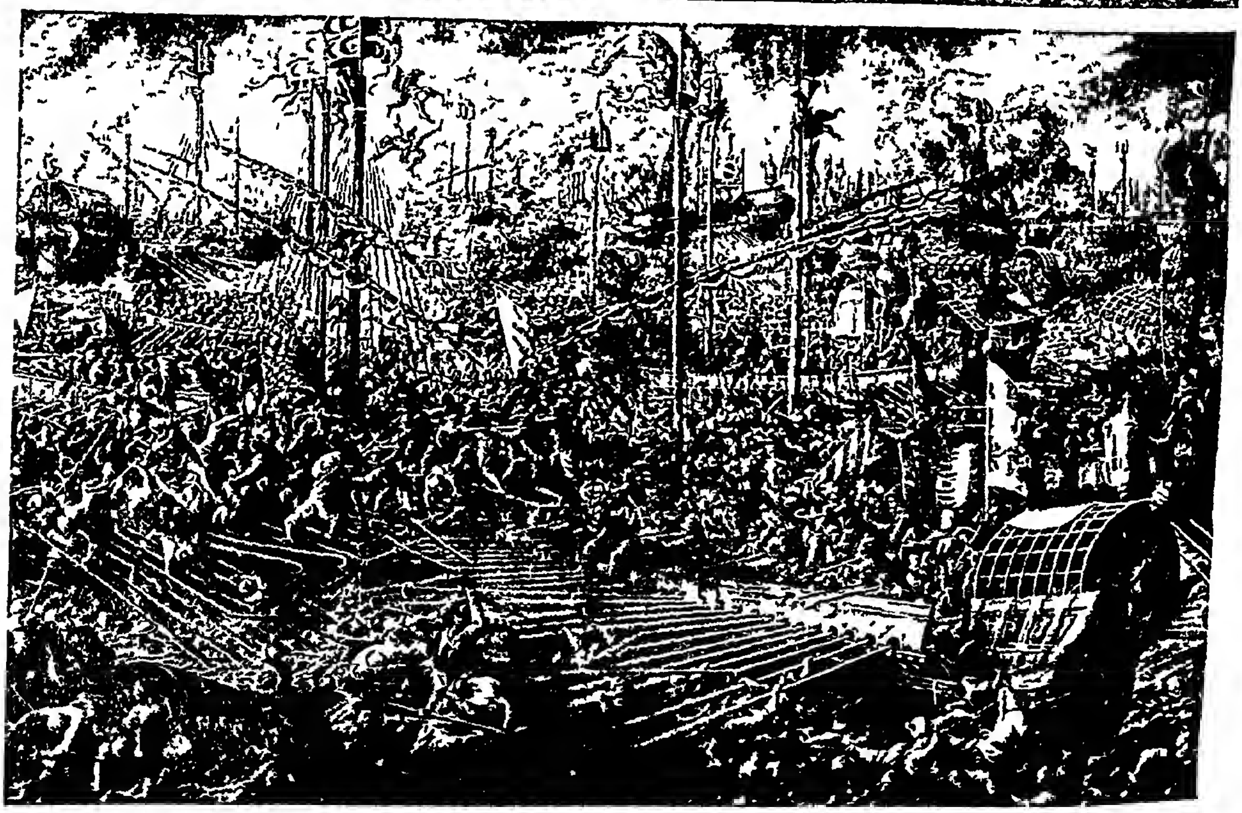
In accordance with the terms of the Armistice after the 1914–18 War the German fleet was surrendered into custody at Scapa Flow, Scotland, to await the decision of the Peace Conference as to its final disposal What a spectacle was that of the silent triumph of a superior sea-power, when, on November 21, 1918, the battle fleet of the Germans steamed slowly between the 40 miles of warships of its British and Allied conquerors, to surrender the power and pride of the German Navy, built up by more than 20 years of costly effort! Never before had ships of such great size and speed, or guns of such tremendous range and punishing power, been opposed to one another on the high seas as they were in the World War Nearly 19 years later, on May 20, 1937, Spithead was the scene of another but very different display of sea-power To the Coronation Naval Review came 160 British warships and 17 foreign ships—many of them of the very latest design—to salute King George VI

At the Battle of Jutland (1916), with aeroplanes and small airships ("blimps") for eyes, wireless and submarine detectors for ears, and destroyers and submarines as patrol guards, the great battleships of the contending

Charles E Brown

'WHOSE FLAG HAS BRAVED THE BATTLE AND THE BREEZE'
This photograph shows H M S Warspite, 31,100 tons in rough weather in the Atlantic during Fleet exercises The great weight and speed of such a ship causes her to cut through the waves instead of riding over them and the forepart of the ship is constantly awash The photograph was taken from the ship ahead whose white ensign is seen on the left The words in the first line are from Thomas Campbell's famous poem 'Ye Mariners of England

CONTRASTS IN TYPES OF WARSHIPS OF LONG AGO



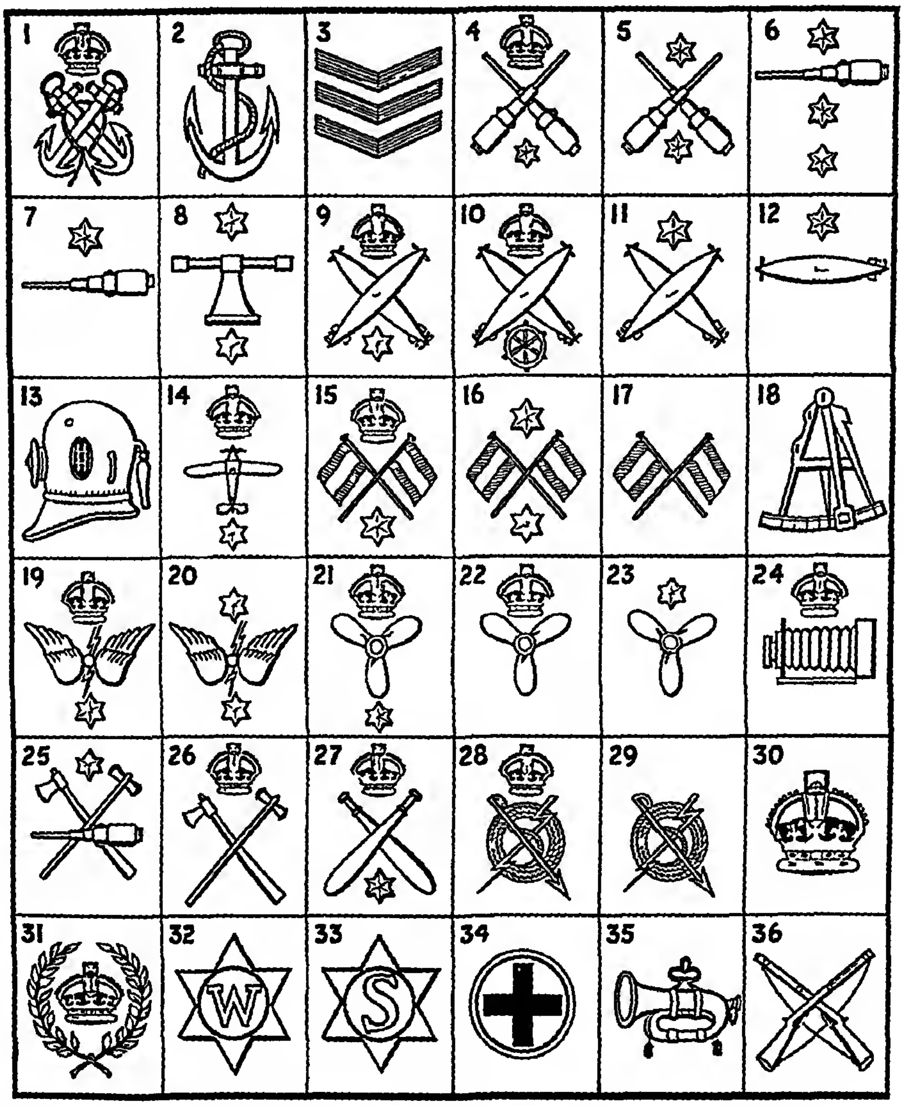
The two illustrations in this page show types of warships of the 16th and 17th century. The lower is from the painting by the Italian artist Vicentino of the battle of Lepanto, fought between the Holy League of Western European powers and the Turks on October 7, 1571. It was the last sea fight in which oared galleys rowed by slaves took part. The upper painting, by Van de Velde, is of the battle of Texel, in which the English fleet under Monk defeated the Dutch under Van Tromp on July 31, 1653. The ships differed little from those of later date except that they carried square sails instead of jibs on the bowsprit.

Lower from the Ducal Palace, Venice; photo Anderson. Upper by permission of the Trustees of the National Maritime Museum, Greenwich

powers opened fire upon each other at a range of ten miles, and at even greater distances in other cases. During war mine-fields have proved to be of the utmost importance, and German submarines have been successful in several instances in destroying British and Allied warships, although the undersea craft have acted chiefly against merchant vessels, which as a rule were unarmed or only lightly armed. The heavily-armed battleships and battle cruisers, which can hurl projectiles weighing a ton for a distance of 20 miles, form the backbone of the opposing navies, but even to day it still remains a question how far the submarine and long-distance, heavy bombing aircraft have limited the effectiveness of such great ships.

Of the innumerable ships composing a navy, first is the battleship, the heavy monster of the fleet. The battle-cruiser is its more athletic son, capable of appearing on the scene of action quicker and putting up a stiff fight until the arrival of its parent, as was the case at Jutland. Its gun-power is less, and its body more delicate, the idea being that "speed is armour." Armoured and protected cruisers (of 8-10,000 tons) are the policemen of the ocean highways. They perform all manner of useful jobs. In addition to looking after traffic—which implies the protection of the commerce of their own country and the arresting of that of the enemy—they scout for information, support the light cruisers and destroyers which spy nearer the hostile coast, attack transports should opportunity serve, and form an excellent third line of defence.

Destroyers, and their big sisters, the flotilla-leaders, are the cavalry of the seas, guarding the larger ships and delivering swift hussar-strokes with torpedoes and guns. As an antidote to the submarine, seeking whom it may devour, they are invaluable. Other enemies of the latter are the various types of aircraft used by the Fleet Air Arm. When afloat, the landplanes are carried on the huge vessels with flat, open decks called aircraft-carriers, while seaplanes are carried on battleships and cruisers, from which they can be catapulted. The little friends of the fleet include mine-layers and



ARM BADGES OF RANKS AND RATINGS IN THE NAVY

1 Petty Officer
2 Leading Seaman.
3 Good Conduct Badges
4 Gunner's Mate.
5 Director Layer
6 Captain of Gun 1st Class
7 Chief Petty Officer (Gunner)
8 Range Taker 1st Class
9 Torpedo Gunner's Mate
10 Torpedo Coxswain
11 Leading Torpedo Man
12 Chief Petty Officer (Torpedoes)
13 Diver
14 Observer's Mate
15 Visual Signalman 1st Class
16 Visual Signalman 3rd Class.
17 Signalman
18 Surveying Recorder
19 Wireless Telegraphist 1st Cl
20 Wireless Telegraphist 3rd Cl
21 Mechanician
22 Petty Officer Stoker
23 Leading Stoker
24 Chief Photographer
25 Chief Armourer and Armourer
26 Chief Shipwright
27 Physical Training Instructor
28 Submarine Detector Instructor
29 Submarine Detector Operator
30 Regulating Petty Officer
31 Master at Arms
32 Writer
33 Supply Rating
34 Sick Berth Attendant
35 Bugler
36 Marksman Badge (Musketry)

mine-sweepers, sloops, high-speed motor torpedo boats river gunboats, repair ships, tankers, store-ships and floating hospitals Lastly, there are the great shallow-draught monitors, ships built like floating forts, very thickly-armoured and carrying one or more enormous 20-inch guns They are used to bombard coasts, destroy submarine and destroyer bases, and to cover the landing of troops In the War of 1914-18 British monitors proved very effective in harassing the German bases on the Belgian coast

Great Britain has always held first place in naval construction, and in 1906 she startled the world by building the first " Dreadnought " This great vessel was then more terrible than any other battleship and was armed only with " all big guns " Immediately the other powers were forced to build ships like the Dreadnought, and all earlier-built battleships were labelled pre-dreadnoughts and regarded as almost obsolete Then came super-dreadnoughts, war vessels which were stronger and more dangerous still, with 14- to 15-inch guns Thus the great powers continued to vie with one another in producing bigger and bigger battleships, whose size was limited only by the size of harbours docks, and marine canals So rapid were the changes that no vessel could be called " first-class " for more than five years, and the dizzily mounting naval budgets threatened to bankrupt all the maritime powers of the world

Probably the busiest class of vessels in war-time are the destroyers, which prove a veritable terror to enemy submarines and are extensively used in patrol and convoy service They were designed to prey upon the torpedo-boat—whence their name " torpedo-boat destroyers," now shortened to " destroyers " Today, torpedo-boats as a separate class—excepting submarines, which are all torpedo-boats—have virtually disappeared , but torpedoes (*q v*) are still a part of the armament of battleships, destroyers, and cruisers

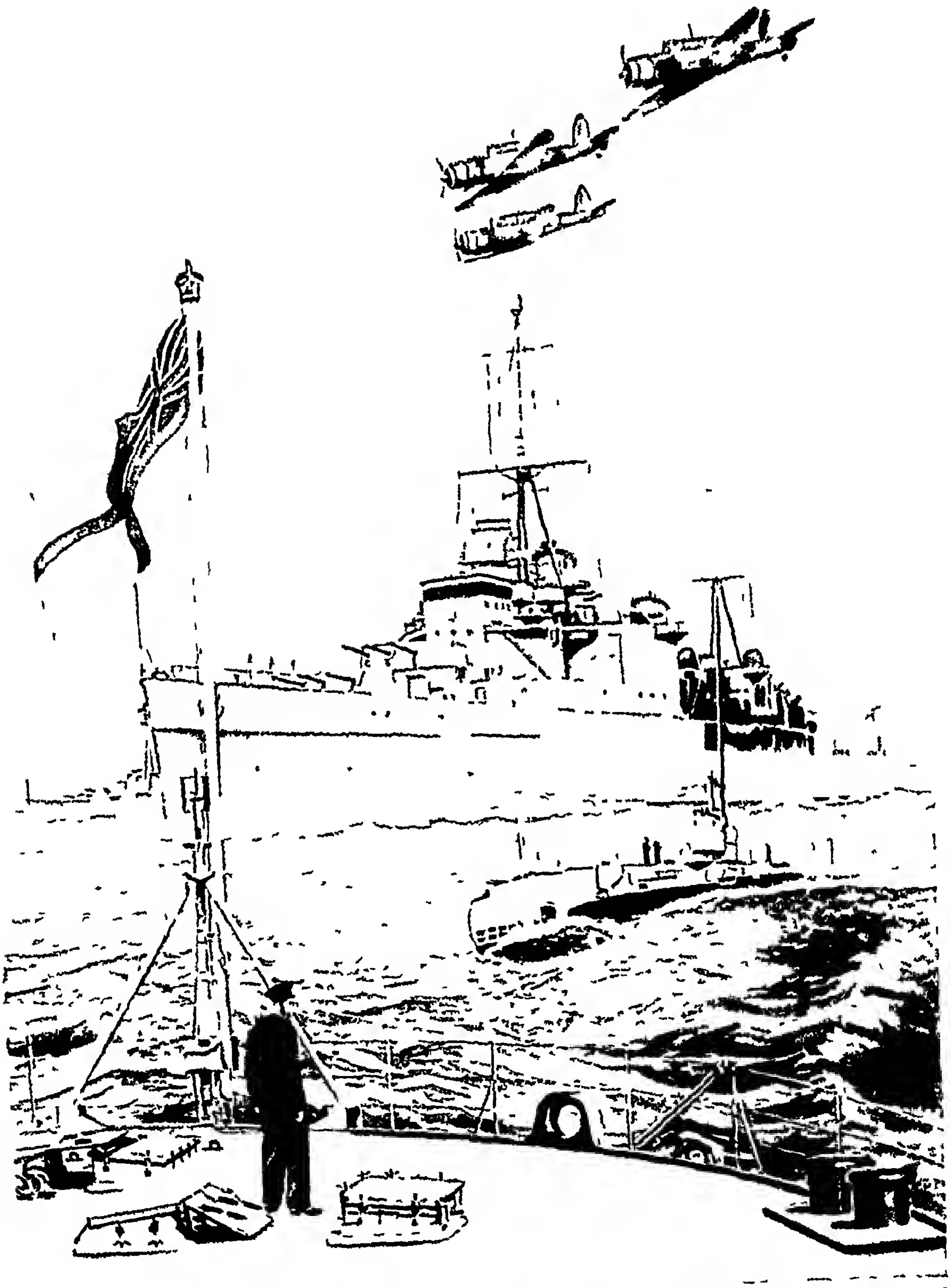
Great Britain long held the view that, owing to her island position and her empire scattered over the globe, considerations of safety made it absolutely necessary to have a navy as strong as the combined navies of any two other powers

Charles F Brown

WHEN THE DAY BEGINS ON BOARD A MAN-OF-WAR

On a man-of-war the sailors sleep in canvas hammocks like those seen in the photograph They are roused in the morning at 5 30 by the boatswain's-mates' piping and loud shout of 'Heave Out ! Show a Leg ! Lash up and stow ! " In the photograph a man is showing a leg by " heaving out " of his hammock Later the men will roll up their hammocks, lash them into a bundle, and then throw them down to the lower deck where others, detailed as hammock-men, stow them away The hammocks are slung from hooks on the mess deck, in the passages, and almost everywhere where there is space available

SWIFT FIGHTING GIANT OF THE BRITISH NAVY



Above is seen one of the splendid cruisers of the Southampton class, which are 591 feet in length and have a displacement of 9,400 tons These cruisers are capable of a speed of 32 knots and mount twelve 6-inch guns and eight 4-inch anti-aircraft guns They have a catapult for launching aircraft, and carry three aircraft for reconnaissance purposes Beyond the bow of the cruiser is a destroyer of the Tribal class, and in the foreground a submarine of the Swordfish class The latter have a length of 200 feet and are armed with a 3-inch gun and six 21-inch torpedo tubes Above are dive bombers of the Fleet Air Arm

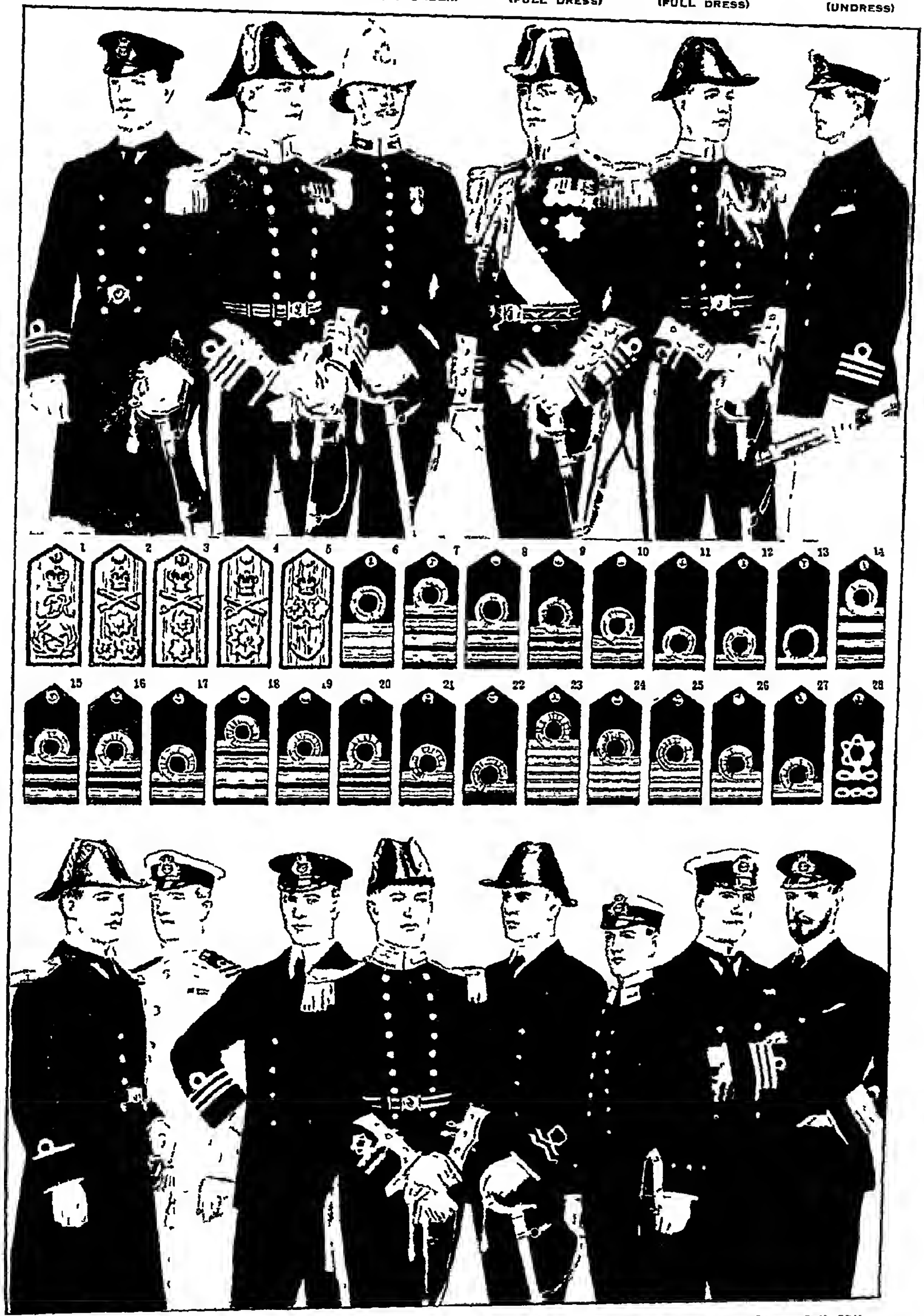
Painted specially for this work by E C MANSELL

2

To face page 2900

UNIFORMS & BADGES OF NAVAL OFFICERS

LIEUT COMMANDER (UNDRESS FROCK COAT) · CAPTAIN (FULL DRESS) · LIEUT OF MARINES (REVIEW ORDER) · ADMIRAL (FULL DRESS) · FLAG LIEUTENANT (FULL DRESS) · COMMANDER (UNDRESS)



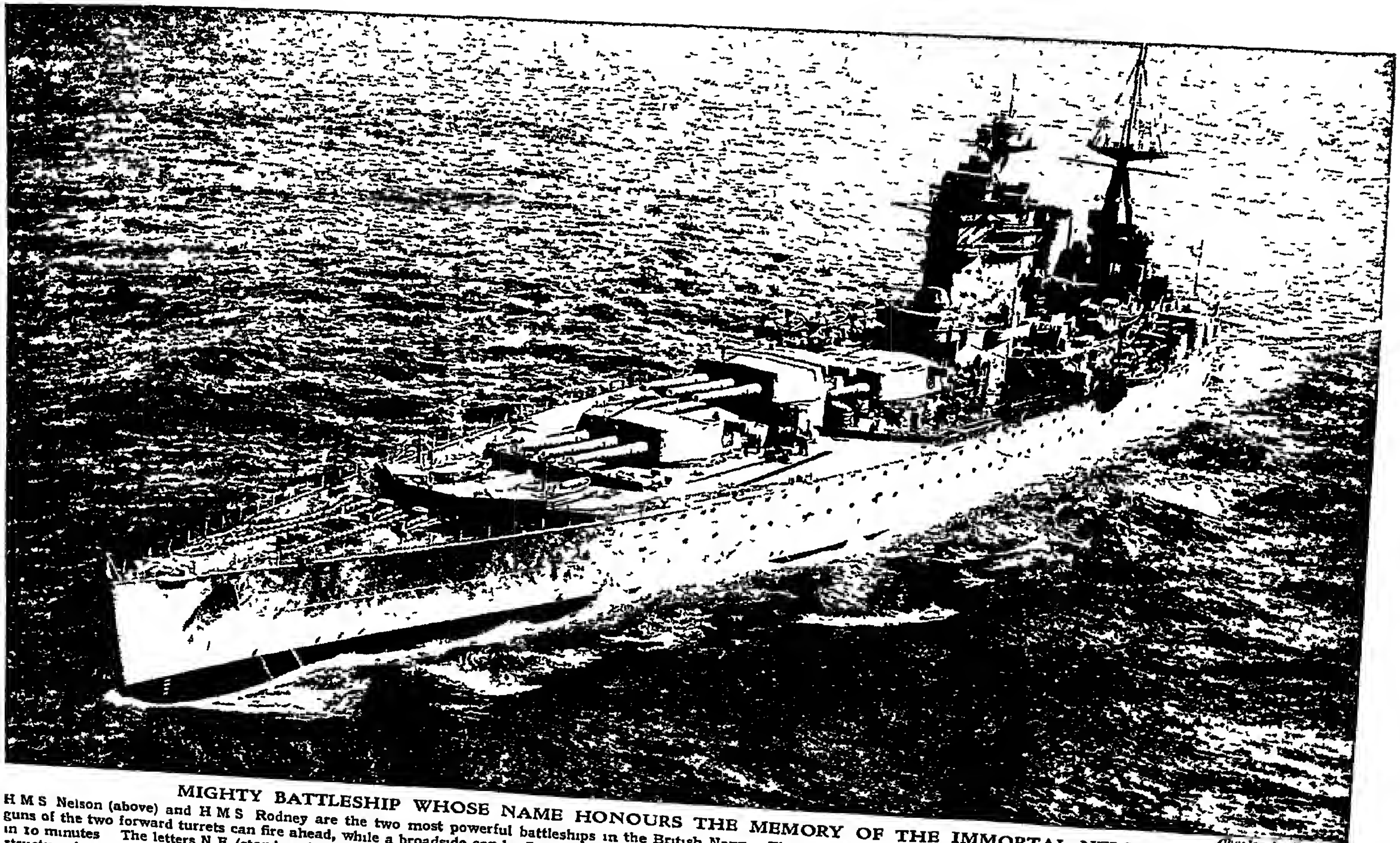
SUB LIEUT (FROCK COAT) · LIEUT (TROPICAL DRESS) · ENG COMMANDER (UNDRESS) · LIEUT R N R (FULL DRESS) · LIEUT R N V R (UNDRESS) · MIDSHIPMAN (FULL DRESS) · SURG COM (UNDRESS) · PAY COM (UNDRESS)

Centre panel shows overcoat rank badges 1 Admiral of the Fleet 2 Admiral 3 Vice Admiral 4 Rear Admiral 5 Commodore (1st Class) 6 Commodore (2nd Class) 7 Captain 8 Commander 9 Lieut Commander 10 Lieutenant 11 Sub Lieutenant 12 Commissioned Warrant Officer 13 Gunner and Boatswain 14 Surgeon Captain 15 Surg Commander 16 Surg Lieut Commander 17 Surg Lieut 18 Engineer Captain 19 Engineer Commander 20 Eng Lieut Commander 21 Eng Lieut 22 Eng Mate (E) 23 Paymaster Captain 24 Paymaster Commander 25 Paymaster Lieut Commander 26 Paymaster Lieut 27 Paymaster Sub Lieut 28 Royal Naval Reserve Lieutenant

CADETS IN THE FIRST STAGE OF SEA TRAINING

Central Press

The boys who are to be the future officers of the Royal Navy begin their training with a course at the Royal Naval College Dartmouth, at the age of between twelve and thirteen. The course lasts for just under four years, and the boys then go to sea in a training ship carrying about 250 cadets and a small crew of trained seamen. The cadets perform the ordinary duties of a ship's crew. Here boys on board the training-ship Vindictive are stowing the after-deck awning



Charles E. Brown

MIGHTY BATTLESHIP WHOSE NAME HONOURS THE MEMORY OF THE IMMORTAL NELSON

H M S Nelson (above) and H M S Rodney are the two most powerful battleships in the British Navy They carry nine 16-inch guns mounted in three turrets so arranged that the guns of the two forward turrets can fire ahead, while a broadside can be fired by all nine guns No heavy guns fire aft The great guns are 60 feet long, and they can fire 12 rounds in 10 minutes The letters N E (standing for the ship's name) painted in white on the after turret enable aircraft to distinguish the ship Just behind the turrets is the bridge structure from which the ship is navigated and the firing of the guns controlled In the stern of the ship can be seen three of six small turrets each carrying two 6-inch guns

and at the beginning of the War of 1914–18 she actually possessed more warships than her two nearest competitors, Germany and the United States, combined During that War both the British and the United States navies were enormously increased by new constructions, while the best of the German Navy was finally sunk by the Germans themselves at Scapa Flow after its surrender

The first great naval battle of which we have a clear story was the battle of Salamis, in 480 B C, in which the Greek fleet defeated a horde of Persian vessels, and saved Athens and the western world from Asiatic invasion These ships at Salamis were chiefly "triremes"—long "galleys" with three banks or rows of oars worked by slaves In the days of Rome's power there were even "quinqueremes"—great high galleys with five banks of oars and rowers, placed one above the other As late as 1571, when the West, as represented by the navies of Venice, Spain, and the Papal States, again defeated the East, as championed by a vast Turkish fleet, at the battle of Lepanto, the vessels used were still galleys, but propelled by a single row of oars on each side

When Navies Took to Sails

The oared galleys, however, were suited only to the comparatively calm navigation of the Mediterranean During the Middle Ages the countries about the Baltic and the North Sea had adapted the sailing vessel to warfare, and the 16th century saw the transformation of all navies from oar to sail Holland, which was then a great mercantile nation, long took the lead in naval power The hardy sailors of Britain showed their power in 1588 by defeating the "invincible Armada" of Philip II, and in the next century they wrested the control of the sea from the Dutch The great diarist, Samuel Pepys, gives an excellent first-hand account of this period of our naval history The 18th century was one long struggle with the French, but Nelson's great triumph at Trafalgar in 1805 definitely established Great Britain's naval supremacy and her position as a maritime empire

The next great changes in naval warfare took place with the introduction of steam power and ironclads, in place of the old wooden sailing ships of war Then began a race among the nations to improve their powder and strengthen their guns, and to defend themselves by building larger and larger warships with heavy armour Fighting vessels became finally forts of steel afloat, yet still guns were able to pierce their hulls New processes of hardening ship armour were followed by new improvements in guns and projectiles, rendering them capable of piercing even 10 inch nickelled steel Fuel oil, which can be stored in small space and is almost smokeless, is now used on all ships in the British Navy The danger in this system lies in the fact that Britain might be cut off from her oil supplies in time of war There has also been developed a system called the "electric drive," whereby the engines run dynamos, and the current is used in motors attached to the screws

Facts About the Modern Battleship

The crew numbers about 1,400 The ship has several anti-aircraft guns, is subdivided into watertight compartments so that even two torpedoes cannot sink it, and is heavily armoured, particularly below the water-line These new vessels are the first British "capital ships" since the completion of the Nelson and Rodney in 1927 Several of the older battleships, however, have undergone extensive refitting The battle-cruiser Hood, which was commissioned in 1920, displaces 41,200 tons, and is at present our largest warship Germany has introduced the so called pocket battleship, a vessel of only 10,000 tons displacement, but mounting six 11-inch guns and having a speed of 26 knots and an enormous ocean range

To prevent ruinous competition in naval building President Harding called the Washington Conference in 1921–22, which established a 5-5-3 ratio for capital ships between the United States, Great Britain, and Japan, with a 1 67 proportion for France and Italy Limitations for smaller craft were agreed upon by the United States, Great Britain, and Japan at the 1930 London Conference A Five-Power Conference was opened in London in December, 1935, for the purpose of reaching international agreement on the further reduction of naval armaments Japan withdrew in January, 1936 In March, 1936, a treaty, signed by Great Britain, the U S A, and France only, provided that for six years each nation should disclose annually to the others its building programme and fixed tonnage and age limits for various classes of ships An Anglo German naval treaty was signed June 18, 1935, whereby Germany agreed to limit the size of her Navy in future to thirty-five per cent of the total tonnage of the combined navies of the British Commonwealth of Nations This treaty was subsequently repudiated As a result of Japan's refusal in 1938 to disclose the size of her new warships, plans began to be made in Britain and the U S A for vessels larger than any before seen The suggested displacement was at least 43,000 tons

A Naval Officer's Career

There are two ways of becoming an officer in the Royal Navy In the first, a boy must pass through a course of training at the Royal Naval College, Dartmouth He must be between the ages of 13 years 4 months and 13 years 8 months on the December 1, April 1, or August 1 before

being admitted, and he must be a British subject and the son of British subjects

Application for admission should be made to the private secretary of the First Lord of the Admiralty The candidates will be asked to attend before the interview committee, which will classify them according to their suitability for the service The First Lord will then select the number required, who will be asked to pass a qualifying examination in English, history, geometry, arithmetic, and algebra The course at Dartmouth lasts for nearly four years—eleven terms, to be exact—after which the naval cadet goes to sea as a midshipman

The second way to become an officer is by a competitive examination, which is the same as the one for the Army and Air Force Candidates for this must be between seventeen and eighteen years Full particulars can be obtained from the Civil Service Commission, Burlington Gardens, London, W 1, or from the Admiralty, Whitehall, London, S W

How to Become a Seaman

Boys can enter the Royal Navy as seamen between the ages of 15 and 16½ They must have the written consent of their parents or guardians, and must reach a certain physical standard, not less than 5 ft in height and a chest measurement of 30½ inches A good elementary education is essential, and eyesight must be perfect They must be of British nationality, and the sons of British-born subjects The boys are trained as seamen, and at the age of 18, if satisfactory, are rated as ordinary seamen and enter upon a service of 12 years

Those who do not enter the service at these early ages can join later The limits of age vary according to the branch which a man proposes to enter Men usually enlist for 12 years, and at the end of that time may volunteer for a further period and so qualify for a pension On their entry into the service recruits are sent to one of the royal naval depots, which are at Portsmouth, Chatham, and Devonport, and there they undergo a period of training in discipline, naval routine, and the duties of their particular rating before being sent to sea A good character and references are required, and before being accepted, candidates must undergo a strict medical and dental examination

Promotion to higher ratings is made as vacancies occur Generally, there are certain tests which a man must undergo to show that he is qualified for the higher rating, and the selection of men for promotion usually depends partly on their seniority and partly on how soon they have satisfactorily passed these tests The rank of petty officer at least ought to be reached during his career by any man of ability who has the personality and ambition to desire the responsibilities of leadership

Men between the ages of 17½ and 25 may enter as seamen for special service They will be required to engage for a period of 12 years, of which not more than 7 years will be served in the fleet At the end of this period of active service they will be discharged, and, if they are in all respects fit and recommended, will be enrolled in the Royal Fleet Reserve to complete a total of 12 years' active and reserve service combined After that they will be eligible for re-enrolment in the reserve under the same conditions as continuous-service men Fuller particulars can be obtained from the local naval recruiting officer

Entrance as an Artificer

A certain number of boys can enter the Navy as artificer apprentices Examinations are held twice a year, in April and October, and the successful candidates then undergo a period of training, being paid a small wage during this time At the end of their training, and after passing the required examination, these boys, being then 18 years old, become engine-room artificers, fifth class (leading rate), and are paid £1 19s 1d a week The training is carried out at Chatham Fuller particulars can be obtained from a booklet called " How to Join the Navy," published by the Admiralty and obtainable from any bookseller

The Royal Navy takes a certain number of young men as paymaster cadets To secure one of these positions the youth must be successful in a competitive examination held twice a year, and must be then between the ages of 17 and 18 years The subjects of the examination are the same as those for entrance to the Royal Military Academy, Woolwich, and the Royal Military College, Sandhurst, with certain exceptions Successful candidates must prove their ability to swim On appointment they are trained for twelve months, partly in H M S Frobisher and the remainder of the time in sea-going ships Full particulars of the examination can be obtained from the Civil Service Commission

Naval Ranks and Services

The officers' ranks in the Royal Navy are, in descending order, as follows Admiral of the Fleet, Admiral, Vice-Admiral, Rear-Admiral, Commodore, Captain, Commander, Lieutenant-Commander, Lieutenant, Sub-Lieutenant, and Midshipman The Home Fleet, Mediterranean Fleet, and China Station are the principal Naval Commands The Royal Marines, who are under the control of the Admiralty (*q v*), may be regarded as sea-going soldiers They wear a distinctive military uniform, and use the Army ranks The Royal Naval Reserve (R N R) and Royal Naval Volunteer Reserve (R N V R) are two other subsidiary Services of vital importance to our national defence